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Hi-Res MAGAZINE™

The Complete Magazine for the Atari VCS & Computer Users

Russ Wetmore on Programming Philosophy

Rosen & Maguire on the Wumpus in Forth

Robert Peck on Assembly in the Post Office

DELL 04316

PLAYER 1
HIGH SCORE
AREA COVERED 17%
THRESHOLD
PITFALL!
GRAND PRIX
FREEWAY
LASER BLAST
FISHING DERBY
DRAGSTER

The Video Game Guru You've Never Heard Of:
Activision's David Crane

The Coin-op Hit:
Qix Comes to the Atari Home Computer

A New Column:
The Family Place

Programs You Can Type:
Number Maze
Music Theory Drill

Plus *Hi-Res* Reviews:
Datasoft, Gamestar, Funsoft & Epyx

Inside:
Kids & The Atari
Part One

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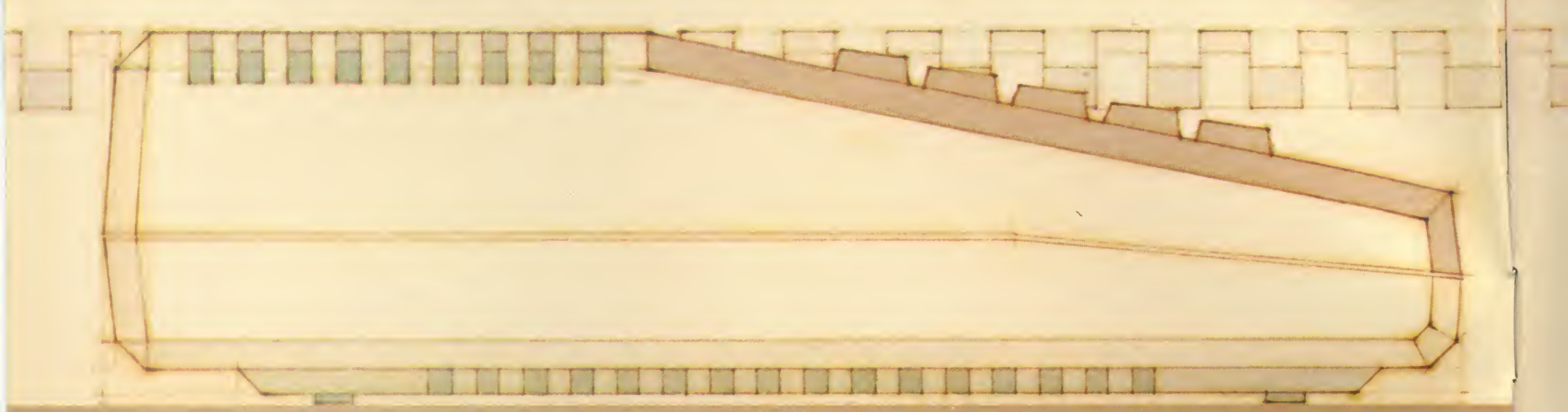

Computer enthusiast Alan Alda uses the ATARI 800XL Computer System. Alda reports: "It's going all the time!"

Introducing the Atari® XL Home Computers: We made them smart enough to know you're only human.

ATARI 600XL
RESET
OPTION
SELECT
START
HELP
POWER

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If you ever find yourself stuck, or have any questions at all, just give us a call. 800-538-8543. (In California, 800-672-1404.) Feel free to talk it over. Because if there's anything friendlier than an ATARI Home Computer, it's the humans who make them so friendly.

You'll do more with Atari Home Computers.

ATARI 800XL
RESET
HELP
OPTION
SELECT
START
POWER

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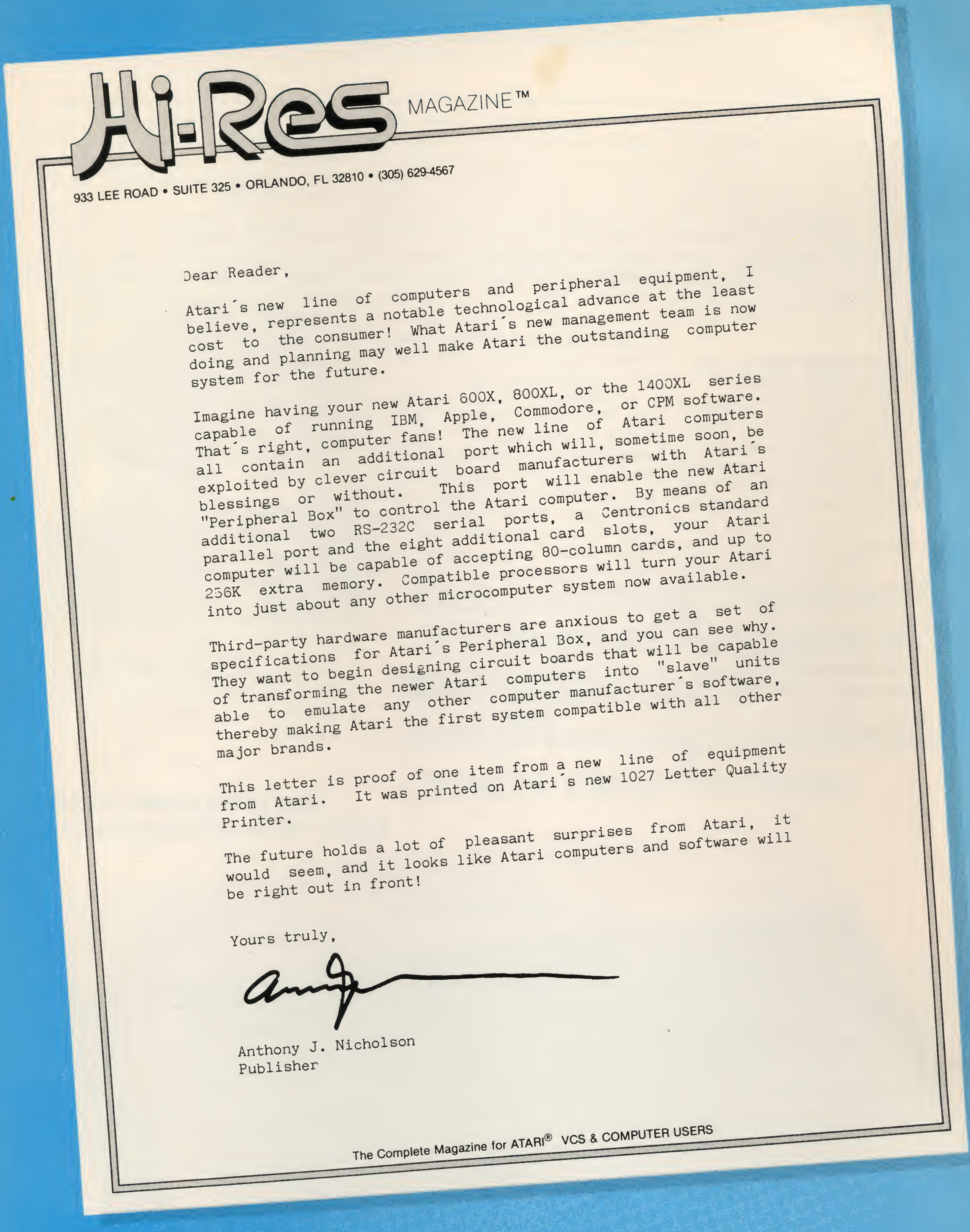


Hi-Res MAGAZINE™
933 LEE ROAD • SUITE 325 • ORLANDO, FL 32810 • (305) 629-4567

Dear Reader,

Atari´s new line of computers and peripheral equipment, I believe, represents a notable technological advance at the least cost to the consumer! What Atari´s new management team is now doing and planning may well make Atari the outstanding computer system for the future.

Imagine having your new Atari 600X, 800XL, or the 1400XL series capable of running IBM, Apple, Commodore, or CPM software. That´s right, computer fans! The new line of Atari computers all contain an additional port which will, sometime soon, be exploited by clever circuit board manufacturers with Atari´s blessings or without. This port will enable the new Atari "Peripheral Box" to control the Atari computer. By means of an additional two RS-232C serial ports, a Centronics standard parallel port and the eight additional card slots, your Atari computer will be capable of accepting 80-column cards, and up to 256K extra memory. Compatible processors will turn your Atari into just about any other microcomputer system now available.

Third-party hardware manufacturers are anxious to get a set of specifications for Atari´s Peripheral Box, and you can see why. They want to begin designing circuit boards that will be capable of transforming the newer Atari computers into "slave" units able to emulate any other computer manufacturer´s software, thereby making Atari the first system compatible with all other major brands.

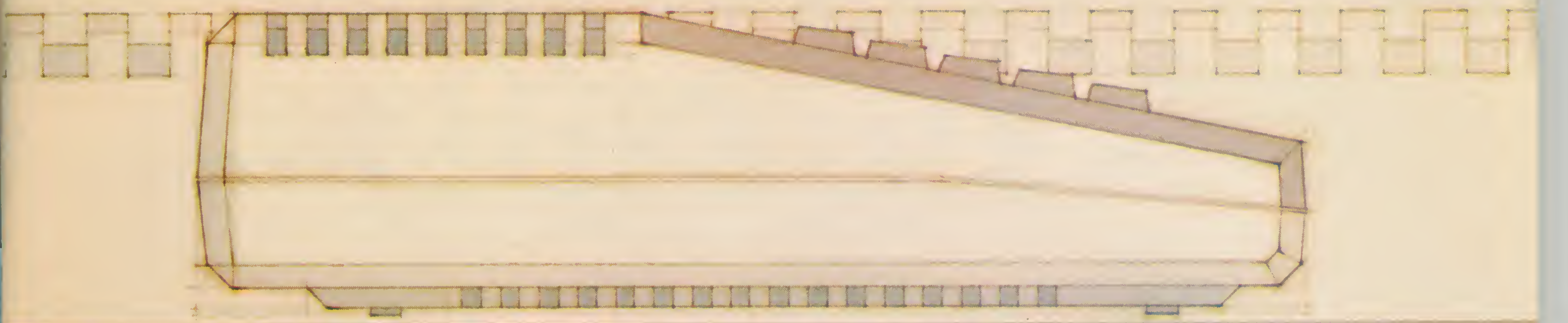
This letter is proof of one item from a new line of equipment from Atari. It was printed on Atari´s new 1027 Letter Quality Printer.

The future holds a lot of pleasant surprises from Atari, it would seem, and it looks like Atari computers and software will be right out in front!

Yours truly,

Anthony J. Nicholson
Publisher

The Complete Magazine for ATARI® VCS & COMPUTER USERS



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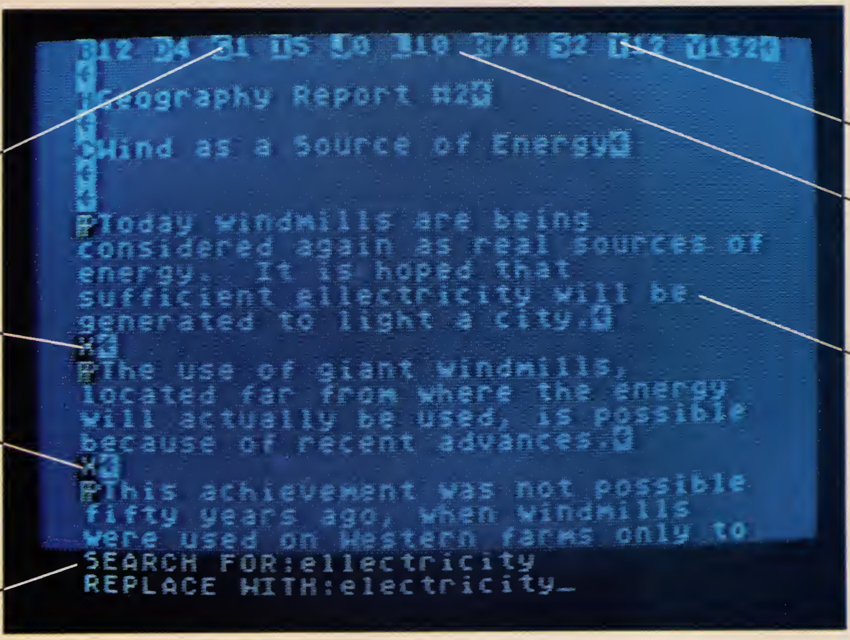

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Geography Report #2

Wind as a Source of Energy

Today windmills are being
considered again as real sources of
energy.  It is hoped that
sufficient ellectricity will be
generated to light a city.

The use of giant windmills,
located far from where the energy
will actually be used, is possible
because of recent advances.

This achievement was not possible
fifty years ago, when windmills
were used on Western farms only to
SEARCH FOR:ellectricity
REPLACE WITH:electricity_
```

Changes line spacing, margins, print type, paragraph indents anywhere in the document.

Instantly reformats.

Enters text easily, with word wrap, one main menu and helpful prompts.

Creates multi-line headers and footers.

Prints double columns, form letters, multiple copies of a page or document, at the touch of a key.

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You can't find a friendlier, more powerful word processor at twice the price. New AtariWriter.™ Under $100.

Now you can do multi-featured word processing at home, simply. At a family budget price.

Our ROM-based cartridge technology means you can use new AtariWriter on any ATARI® Home Computer (even 16K) for personal and business correspondence, term papers, committee reports, mailings, etc.

It also lets you choose between cassette and disk storage systems.

One very special AtariWriter feature: you can correct as you write, without switching back and forth between Create and Edit modes.

And our memory buffer offers an "undo" command to let you change your mind, and restore text you've just deleted.

Check into our remarkable AtariWriter, and our choice of letter quality and dot matrix printers, also reasonably priced, at Atari dealers. Call 800-538-8543 for dealer nearest you. In California, call 800-672-1404.

You'll do more with Atari Home Computers.

ATARIWRITER
ATARI

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Contents

HI-RES MAGAZINE JANUARY 1984 VOL. 1 NO. 2

NUMBER MAZE 26

by Sol Guber

Here's a program that's both fun and educational. Sol shows you how to construct math mazes of your own. Test your number skills and problem solving ability.

OH, THOSE @#&! ERROR MESSAGES 32

by Steve Harding Part II

Not quite everything you want to know about another serving of Atari's error messages. West Coast Editor Steve Harding explores more of those cryptic codes.

MUSIC THEORY DRILLS 40

by Duane Tutaj

A music drill educational program that you can type. Duane Tutaj opens a series on music appreciation. In the future, he'll help you create your own tunes.

VIDEO GAME GURU ACTIVISION'S, DAVID CRANE 46

by Colin Colvert

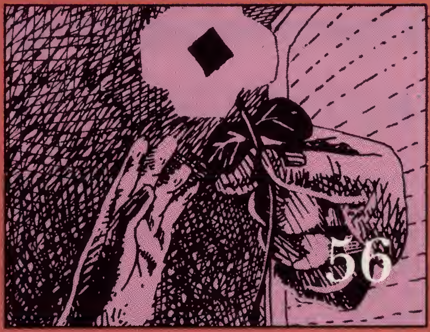
The creator of *Pitfall's* Harry and other Activision hits, David Crane, talks candidly about his programming career. He shares some frank views of Atari and his experience in their game software department.

PITFALL!
GRAND PRIX
FREEWAY
LASER BLAST
FISHING DERBY
DRAGSTER
46

THE FAMILY PLACE 56

by Dorothy Heller

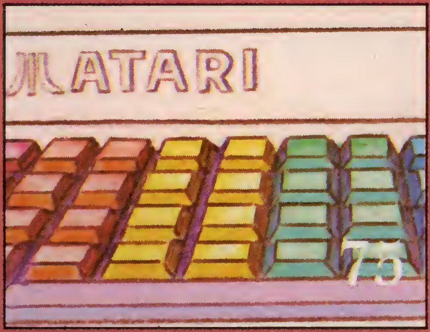
Dorothy Heller starts her series with some pre-school and early learning programs from the Learning Company.



KIDS AND THE ATARI PART 1 OF A SERIES 75

by Ed Carlson

Hi-Res will serialize a few lessons from Ed Carlson's book for beginners. There's help for parents or instructors before each lesson.



Departments

Publisher's Letter 2
In This Issue 6
Perspectives 8
Reviews 11
Academic A
by Lloyd Prentice 18
Survival
by Dan Horn 20
Silicon Valley Reporter
by Bill Haslacher & Steve Harding 36
Some Assembly Required
by Robert Peck 60
Graphic Evidence
by Tim McGuinness 62
Cryptics 65
Advanced User Forum
by Russ Wetmore 66
Strolling Forth
by Evan Rosen & Steve Maguire 70
Previews 78

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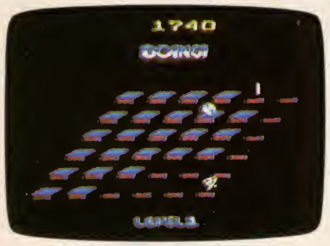
ARCADE AWARDS
19 84
ELECTRONIC GAMES MAGAZINE

First Star Has 4 New Games.

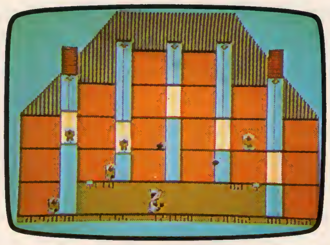
Fernando Herrera, the designer of *ASTRO CHASE* (1984 Science Fiction / Fantasy Computer Game of the Year*) and our design team again define "State of the Art."

Superior graphics, real-time animations™, multiple screens, intermissions, arcade-quality sound, innovative gaming, challenge and excitement—we deliver it all!

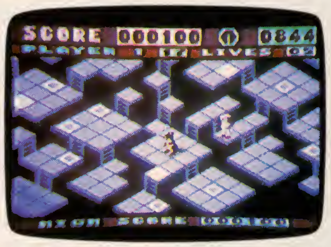
THE BAD NEWS? You can't play them all at once.



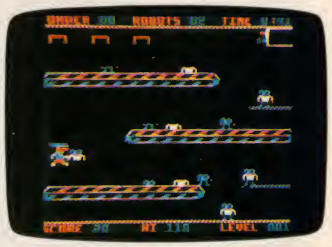
BOING!™
Designed by Alex Leavens
& Shirley A. Russell
Atari VCS 2600



BRISTLES™
Starring Peter the Painter
Designed by Fernando Herrera
Atari Home Computers
Commodore by Paul Kanevsky


SCORE 000100
PLAYER
LIVES
SCORE 000100

FLIP and FLOP™
Designed by Jim Nangano
Atari Home Computers
Commodore by Adam Bellin


ROBOTS 02
TIME
SCORE
HI 110
LEVEL

PANIC BUTTON™
TRS-80 Color Computer
by Paul Kanevsky
Commodore Computers

*Electronic Games Magazine 1984 Game Of The Year Award

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Hi-Res Magazine is a division of
Compupress, Inc. Editorial Offices at
933 Lee Rd., Suite 325, Orlando, Florida:
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In This Issue

For those of you who enjoyed Colin Covert's turbulent history of Atari's early years in our premiere issue, he has returned to our pages with an engrossing profile of a programming millionaire—and the company he works for. David Crane created Activision's most successful 2600 video game to date, *Pitfall*. Find out why he's smiling inside Hi-Res.

You 1200XL programmers might want to take note of Tim McGuinness's "Graphic Evidence" column. He's offered 1200XL bit map that a number of readers requested.

We've added Dorothy Heller's column "The Family Place" to our regular contributors. Dorothy will be talking about computers and their affect on the family, as well as reviewing pre-school programs.

This month kicks off the first of a serial of chapters from *Kids and the Atari*. The book, written by Michigan State professor, Ed Carlson, was produced by Datamost with support from Reston Publishing. The book comes with instructions to both parent and teacher and lists assignments for the student after each lesson.

Atari Corp. has taken much abuse in the press over the last quarter of 1983. Despite additional third quarter losses, the fiscal bleeding appears to have been staunched.

Some Wall Street analysts and members of the business press heaped a final dose of criticism on the company for not keeping to a production schedule on the 1400XL and 1450XL. But such stories stretch the credibility out of their criticism. Last summer, Atari promised four new computers, a 2600 add-on keyboard, the much touted expansion box and a CP/M add-on. Then, they lost nearly $350 million, changed chief operating officers, exchanged a division president and laid off nearly 3,000 employees.

Let's be reasonable, no matter how rife with waste a corporation is, you can't believe that 3,000 persons were simply standing around a water-cooler exchanging snappy chatter.

Eliminating employees out of a desire to survive as a corporation is bound to raise havoc with product schedule.

For those of you who are still trying to find the missing operands from our "Zounds Sounds" article last month, you'll find the corrected lines in this month's Perspectives section.

This month's reader-written programs include a *Music Theory Drill* by Duane Tutaj that will open his article series exploring music on the Atari. We've also included *Number Maze* by Sol Guber, a program that combines education with creative fun.

"Some Assembly Required" has you managing your own Post Office by the numbers. See Robert Peck's column for some beginner's insight into machine-language programming.

Enjoy our second issue!

The ultimate current event.

Edison, the kinetic android, leads a frustrating life.

All he wants to do is build his circuit boards and go with the flow. But things keep getting in the way.

Nohms—a negative influence—bug him constantly. They're harmless, but only from a distance.

Flash, the lightning dolt, disconnects everything in his path. Which can be frustrating after a hard day on the circuit.

And the cunning Killerwatt is out to fry poor Edison's brains. But our hero simply solders on.

Compute's Gazette calls Juice! "a knockout...the graphics are top-notch and the play action is fun for five minutes as well as five months."

Try Juice! yourself. You'll get a charge out of it.

Developed by Arti Haroutunian
Available for your Commodore 64™
and Atari Home Computer.

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Perspectives

Rock and Roll Is Here to Stay

Perhaps Atari's austerity diet under new Chief Executive James Morgan offered too lean a meal to the remaining troops.

John Cavalier, the president of the recently formed Atari Products Co., left Atari's bean supper for the trencherman's table set at Apple.

Cavalier quit in October. He is the man credited with overseeing the development of Atari's new XL series of computers. That carries with it the stigma of Atari's initial problems with the 1200, an XL prototype, and the "later than expected" introductions of the 600 and 800XLs.

Technical or marketing blunders seems an unlikely reason for Cavalier's departure, however. His grades were good according to sources inside Atari, Warner and John Scully the president of Apple. Apple had been looking for four months for someone to take charge of their Personal Computer Division and found Cavalier through an executive search firm.

A more likely explanation of Cavalier's departure—in addition to a money offer from Apple—was given by Geoff Holmes, a VP at Warner Communications in New York. According to Holmes, who was close to the situation, Cavalier may not have been satisfied with his role as President of Atari Products Co. The reorganization at Atari this year broke off the manufacturing, distribution and marketing duties under three separate presidents. Cavalier, who had total responsibility for the computer division, surfaced with only the marketing arm of the company.

The single puzzle is Cavalier's cryptic comment, quoted in *The Wall Street Journal*: "I think there's better opportunity at Apple. Apple has a definite commitment to the computer business and a total dedication to it."

Such a comment tossing in the wake of rumors that Atari will abandon the hardware or software market gives the press "pause to wonder."

Sallie Stephenson is a freelance writer from Minnesota.
George Owen is a writer for the Florida Times/Union *and the* Jacksonville Journal, *Jacksonville, Florida.*

Very Lumpy Rumors

According to sources inside Atari and Geoff Holmes, a VP at Warner Communications, who is in charge of all communications, Atari is not for sale, nor has it ever been. Atari isn't removing itself from the small computer business—neither in hardware or software.

"Of course we're (Warner) concerned with the magnitude of the losses... We're analyzing all different aspects of their (Atari's) business," said Holmes. Although Warner has always approved or disapproved Atari's budgets, Holmes said, "We haven't always been intelligent about our spending."

Describing Atari's hundreds of millions of dollars in operating losses as "lumps," Holmes said that Warner was taking them in the short term.

"We (Warner) really are committed to the computer business," said Holmes, "We're not cutting research and development."

Holmes said, "If you go back and analyze the business, Atari's profits were always higher than they should have been because they (Atari) were growing so fast." According to Holmes, Warner has always maintained that position.

Atari wants to win back support from its jilted distributors, and, without speculating on new products and their entry date, Holmes said, "As you look out, (into the future) we'll be spending a fair amount on products that they (independents) will market."

He also said that plans for the new subsidiary Atarisoft, include opening up the corporation's extensive marketing channels to other software companies. Holmes promised complete cooperation to those companies developing software for the Atari under their own labels or those who wish Atari to market the products for them.

Though Holmes said the new 1400XL and 1450XL were on schedule, later re-

Hi-Razzz

An editor derives no pleasure from criticism, especially when it comes from an 11-year-old.

That's what happened as the premiere issue of *Hi-Res* swept off the presses.

Chad Garrell pointed out the folly of running two views of the Level Ten screen from Big Five's arcade smash, *Miner 2049er*.

You'll find the actual screen shot of Level Nine adjacent to this item.

Minus 2049er, Level 9

When the editorial culprit was grilled about his myopia, he admitted with customary literary rancor that "all screen shots look alike in the dark."

ports indicated that the computers might be shipped in late December. Others speculate that Atari will not follow through with these two machines.

The Prime Market

Just how important are the 20 million homes in America with one or more school-age children to the video game industry? Very important, according to a recent survey by Scholastic Inc., which publishes Scholastic magazines.

Today, it is the teenagers, ages 12 to 19, who are providing parents with the incentives and technical know-how to buy hardware, software, disks, and cartridges.

Nearly 50 percent of the households with teenagers already own a video game system, and by the end of this year about 20 percent are expected to own a home computer.

In 49 percent of the households, a teenager was credited with making the brand decision.

In 5,458 households surveyed, Atari video games and computers were at the top of the list of units owned, or to be considered for purchase.

Box-Top Video Games

Those teenagers credited with providing their parents with incentives to buy video games and computers can now help their schools out much the same way, only it won't cost them a cent.

Post brand cereal lovers are now able to help their area schools receive a computer and software in exchange for box-top seals in a promotional campaign that was dreamed up by General Foods Corp. and Atari.

To qualify for the Atari equipment—800XL and 1450XLD home computers, printers—cassette and disk-drive units, schools must collect a certain number of proof-of-purchase points, which are based on the size of the cereal box.

The timing of the computer campaign coincides with the formation of the Atari Educational Group, which will offer computer equipment and educational products for students ranging from kindergarten through college.

Line Changes for Zounds Sounds

```
15 C=PEEK(764):IF C<>33 THEN POKE 764,
255:GOTO 20
20 IF FLAG(I)<>1 THEN SOUND I,S(I),D(I
),10
24 POKE 704+I,C(I):IF PEEK(644)=0 THEN
 I=I+1:IF I=4 THEN I=0
30 IF X(I)<61 THEN X(I)=61
31 IF S(I)<0 THEN S(I)=0
32 IF X(I)>189 THEN X(I)=189
33 IF S(I)>253 THEN S(I)=253
35 IF Y(I)-3>=16 THEN 37
37 FOR J=0 TO 12
42 IF Y(I)+3<=82 THEN 44
52 IF (PEEK(632)<>15 OR PEEK(644)<>1)
THEN RETURN
53 COL=COL+1:IF COL>255 THEN COL=0
55 C=PEEK(764):IF C<>255 THEN 15
```

Vacationers Getting an Education

Club Med, the world's largest vacation village organization, and Atari have scored with their visitors by combining to teach computer technology in a relaxed atmosphere to guests as they are vacationing. So far, it is reported, 11 of the clubs 100 villages are using 12 to 25 computers.

Texas Instruments Pulls Out

As we go to press, we have just been advised that Texas Instruments has announced that its departure from the home computer industry is certain. It is hard to believe that this does not give Atari an ample opportunity to enlarge upon its computer-user base if its marketing and manufacturing can be brought forward in meeting market needs.

Additionally, Texas Instruments also announced that it is not sure whether or not they are going to continue to service its already large consumer base with support of additional software. It is understood that a decision of its continuation of production of new software, or even continuing manufacture of old software, will be made sometime in the first quarter of 1984.

This news should come as comfort to the newly-formed Atarisoft, a subsidiary of Atari, brought into existence to reproduce Atari software translated into universally compatible software. They are actually reproducing what—up to now—was exclusively Atari software to be compatible with other systems such as Commodore, Texas Instruments and others.

Just Plain Bunk!!

There was a national news release carried in several United States and foreign papers alluding to the fact that Atari had taken 14 truckloads of new software cartridges and hardware and dumped them into a site near Almagordo, New Mexico, where they were covered over with cement.

Just not true!

This type of journalism, which is irresponsible, however spicy to a news-hungry reporter, creates the type of problem that has compounded Atari's dilemma.

Not only was this particular article unworthy of the notoriety it received: It was totally fabricated out of unreality. There is always the seeker of fame through misinformation.

The truth as reported by James Morgan, president of Atari, is that nothing but unrepairable hardware and defective cartridges were dumped.

We would like to think that this publication stands above any writer's urge to sensationalize copy, for whatever reason.

What began as an experiment in introducing computing skills to children has expanded to include adults. The curriculum is 12 fun games and six educational games including chess, language courses, biorhythm charts and four programs along the lines of family budgeting.

At the extensive program in Punta Cana resort in the Dominican Republic, tennis-playing club members can get in a little practice with the Atari Real Sport tennis game at a courtside terminal or visitors can learn to weave by computer, blending 256 colors and hues on a TV screen as you would weave yarn on a loom. A wide variety of workshops with different levels of skill are offered, as well as basic programming information about computers.

Information on Club Med is available from any travel agent or by calling toll free (800) 528-3100. *Hi-Res* will run a feature report in the next issue.

by Sallie Stephenson

Fox Sees Bright Video Future

Video game players in the future may be programming the exploits of Lee Majors, and, if they bungle the job, the "heavies" might win.

According to Frank O'Connell, president of Fox Video Games, computerists might see any number of their favorite characters in a new medium—the computer game.

O'Connell was talking about the personal computer being wed to the video disk, which, he said will place computer games and their players into a whole new world.

"The new games," O'Connell told Hi-Res, "will provide experiences, not just games."

Fox, whose first entry for the Atari 2600—*MASH*—fell short of market expectations, is rebounding to growing criticism that video and computer game tie-ins to popular movies and television shows are a financial bust, not a boon to the industry.

The *MASH* cartridge, based on the popular series, carried a free tee-shirt, but its spectacular introduction couldn't guarantee market performance. The cartridge wore about as well as the tee-shirt. Any number of VCS tie-ins with movies and television themes have failed to perform as expected—notably, *E.T.* and *Tron.*

The major factor in the lackluster success of such games appears to be the player's disappointment in the action and graphic recreations of characters they have come to know and feel comfortable with.

Pitfall Harry, for example, is doing a bang-up business and it's probably because he was a video original from Activision.

"It's extremely difficult to take expectations of a licensed product and make it an interactive game," said O'Connell. He blames the technology: "The 2600 is just too crude."

O'Connell and Fox Video aren't giving up. They are moving ahead with both video and computer games and waiting for the technology to grow up around their games.

"We saw the 2600 as merely a stepping stone," said O'Connell, "The strategy (basing games on television and movie themes) makes a lot more sense as the technology proceeds. It's just that some (companies) have been burned following it."

Though O'Connell promises that both *MASH* and *Porky's*—based on the movie by the same name—are greatly enhanced products on the Atari home computer, it's his opinion, the hardware to transform the computer game industry is just now coming on line.

O'Connell saw a number of forms that this new technology might take. "One will be a separate interactive disk. This will be slightly more expensive than the passive video disk. You'll have to hook it up separately to a personal computer to make it interactive."

Another scenario requires a manufacturer to create a plug or interface box.

"The third option is an onboard disk (video) in a personal computer."

But the price, continued O'Connell, has to come in at about $400.

Meanwhile, Fox has not abandoned its plans to support the Atari 2600. They have released both *Crash Dive*, a video original and *The Fall Guy*, based on the television series. The company plans to convert both to the Atari microcomputer and with Twentieth Century Fox's archive of film and television shows, the company is well-placed to take advantage of what O'Connell called the new technology.

Fox Awaits New Technology

Fox Video Games is preparing to meet the "new computer technology" with a different type of software team. Described by Paul Laughton, director of internal product development, as a synergistic approach, Fox is enrolling graphic artists, musicians and sound engineers as well as game designers and programmers to their video game development teams.

Each team consists of six to eight individuals with one of the above specialties, and each team will be working on approximately eight different projects.

The teams will be employing the newest techniques for producing games. By videotaping sketches created by an artist, a team will be able to see a prototype of a video or computer game in a short time.

Sound and graphics will be programmed separately. Sound, for example heightens a player's mood. According to John Wentworth, a Fox sound engineer, "Sound has a psychological impact that bypasses the thought process and works directly on the emotions."

In the future Fox will develop games that will develop games that will utilize the so-called supercartridges for the 2600, those with expanded ROM, and synthetic voice technologies.

Reviews

Qix
Atari, Inc.
Sunnyvale, CA
400/800/1200
Cartridge
$39.95

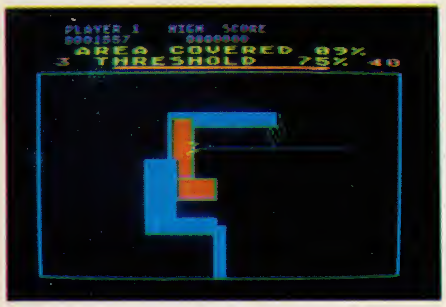
by Pat Henderson

Qix is the latest cartridge game from Atari that first made the rounds as a successful coin-op. If its success in the coin-op world is duplicated on the home front *Qix* should rush to the top of the charts soon.

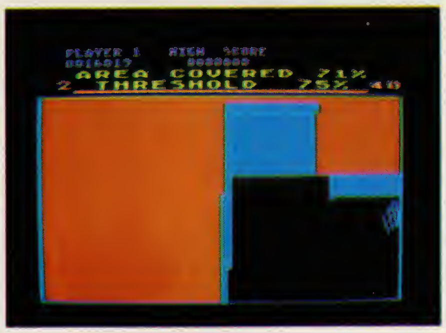
The object of the game is to trap the *Qix* (a swirling helix composed of four short rotating lines) in the smallest possible screen area. To trap the *Qix* you must draw lines around it with your joystick-controlled Marker and enclose more than 75% of the playing area with boxes of color.

Creating a box is simple. Just guide the *Qix* into contact with either a screen wall or another box. Once completed, a box fills with red or blue—the color being determined by your drawing speed. Quickly drawn boxes fill with blue and earn fewer points. The catch-22: slowly drawn boxes may give you many extra points, but the *Qix* has more time to annihilate your Marker. The only way that a *Qix* may destroy your Marker is by touching the lines of an unfinished box. Once a box is finished and your Marker has returned to another finished box, or the side of the playing field, you are safe from the ever-swirling *Qix*. After you fill 75% or more of the screen with color three times, the *Qix* splits in two, creating double trouble. Point values double if you can drive your Marker between the splitting *Qix* and move safely to the other side. Incidentally, a completed box containing a *Qix* will not fill with color.

Pat Henderson is a regular contributor to Hi-Res.



Qix *from Atari*



Sparx Menace

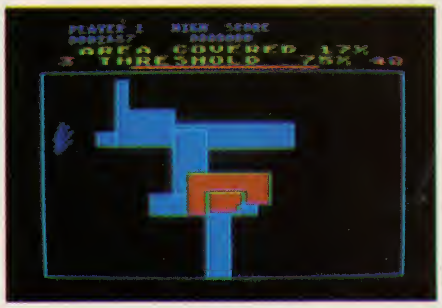
To keep you and your Quick-Draw McGraw Marker from resting too long, Atari has thoughtfully provided menaces called Sparx. These little electronic devils roam about the finished boxes sniffing for your graphite vapor trail. Fortunately, Sparx never roam on the lines of an unfinished box, only on the sides of completed ones and the edges of the playing field. At the top of the screen, a line that clocks the game time decrements during play. Two more Sparx will appear as a penalty if the lines decrements completely three times. This process repeats until a maximum of eight Sparx appear at one time.

If you manage to avoid the *Qix* and Sparx, then watch out for the Fuse. The Fuse is a constant reminder not to stop drawing a box once you've started. Should you pause for more than a second or two, the Fuse ignites and races up your Stix in an attempt to destroy your Marker. To douse the Fuse, just resume drawing the box. If you stop again, the Fuse begins burning from the point at which it stopped before.

The top of the screen shows various game information, including player one and two scores, the percentage of area enclosed so far, and a gentle reminder to complete that crucial 75% of the screen area. Additional information includes the number of Markers remaining (you start with three), and the Sparx time bar. Each game begins with the time bar set to 40 seconds, but you can vary the setting from 10 to 90 seconds.

A good playing tip is to keep your guard up. Watch everything, especially the Sparx, because they become more difficult to see as the screen fills with completed boxes. Many small boxes may seem to confuse the sparx, but their confusion is usually short-lived.

The *Qix* is a hard helix to beat, and the best defense is to avoid it like the plague. But if you are resting on the side of a box, or the side of the screen, you can taunt it. Here's how: When a *Qix* is touching the side of a box or screen, you can move right through it or touch it



Qix *from Atari*

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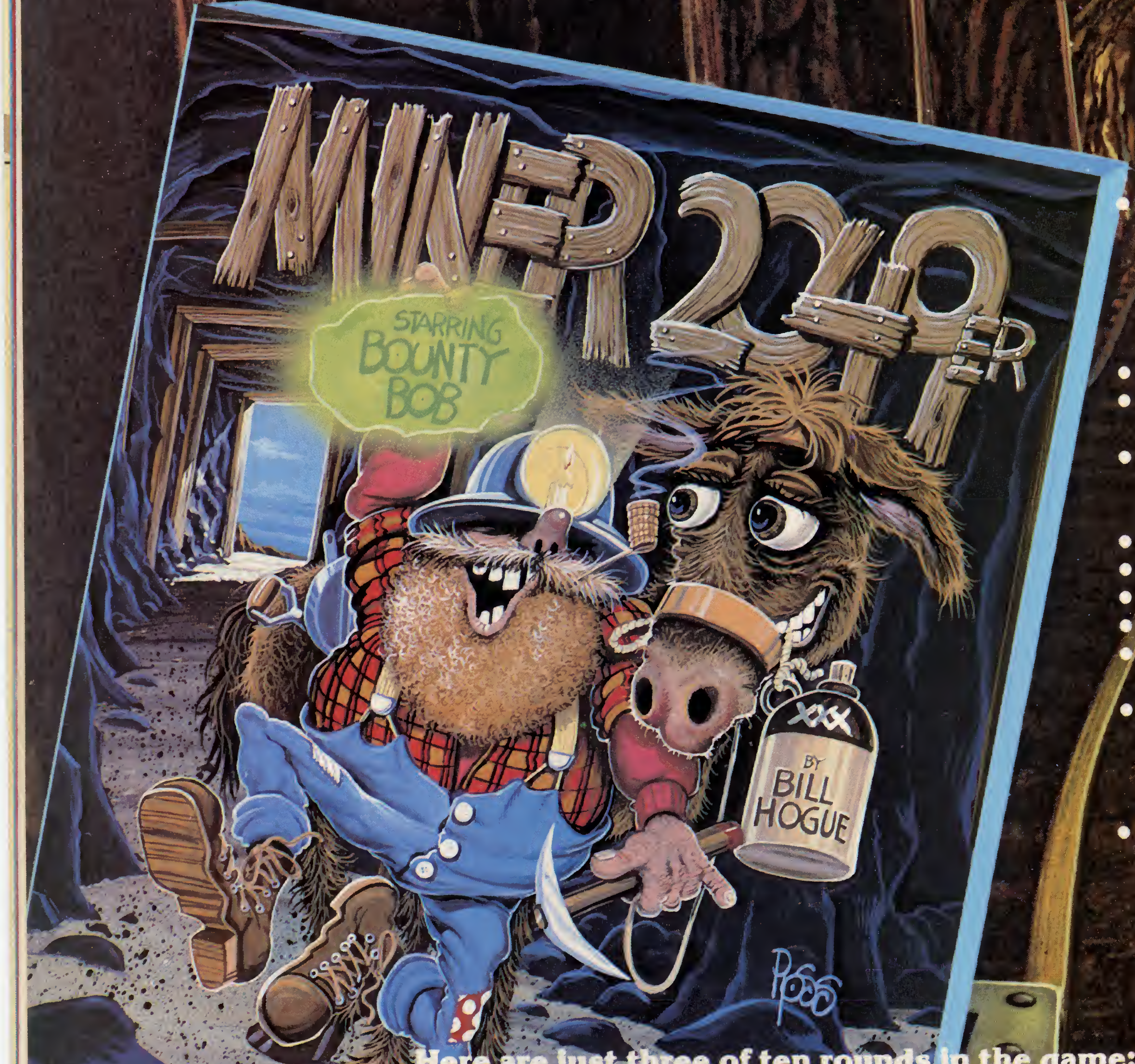

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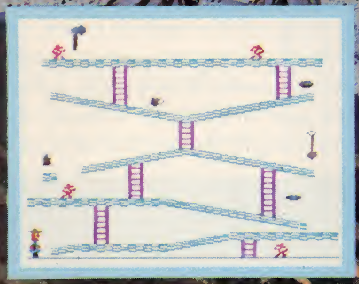
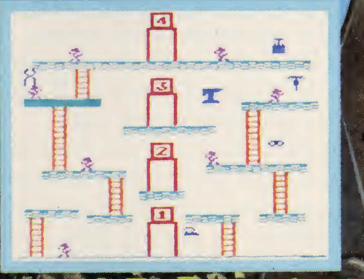
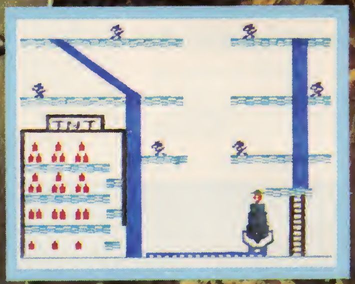


Round 1: The Mine Shaft.
Sharpen your miner's skill!



Round 3: The Transporters.
Beam yourself up!



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A "klutz-no-klutz" player option would be nice, especially as a player handicap.

without being obliterated. But once it moves off into the coldness of its domain, beware! Box in the *Qix*, and the entire screen (except for the area the *Qix* is in) will fill with color.

The best playing tip comes from the champions of the coin-op *Qix*! Try to build a wall of little boxes through the middle of the screen. When you reach the top don't complete a box to the other side; instead, turn and start building a horizontal wall in the direction of the *Qix*. When the *Qix* starts in your direction just dart back to your ever-growing wall. The idea is to trap the *Qix* in a small area and not fill in the rest of the screen until the *Qix* is enclosed in a small area. Execute this technique properly, and you'll reap extra points.

Summary

The good news is that the home version of *Qix* is one of the best adaptations of a coin-op game Atari has produced lately. Fans of the quarter-chewing Arcades version will find that the cartridge rendition of *Qix* is a solid remake of the original. And first time *Qixers* should be especially delighted with this, one of the most original and addictive games to come down the pike in quite a while.

Time Runner
Y. Lempereur
Funsoft, Inc.
Agoura, CA
16K
400/800/1200
$29.95

by Jeannie Gutierrez

Time Runner by Funsoft, Inc.,.is a game belonging to the *Pac-Man* genre. The object of the game is to stay alive and capture space territory while avoiding the deadly Defender-Droids.

The colorful introductory title screen uses a scrolling technique similar to the Atari Logo demonstration program. Pressing the Start button clears the introductory screen and displays what is called the "Rush" screen. This screen consists of multiple rectangles within one large rectangle. The *Time Runner* himself is a green, elliptical-shaped "man." The player is challenged to maneuver the *Time Runner* around the dotted-line borders and capture space territory. You score points by completely tracing a rectangle. This may seem like an easy task, however, there are four Defender-Droids pursuing the *Time Runner*. Contact with a Defender-Droid will cost you a life. Initially you have three lives, and for each 10,000 points an additional life is awarded.

The *Time Runner* is quite easy to move, and responds quickly to the joystick. Although I managed to capture territory, I didn't move quickly enough to avoid the Defender-Droids, who annihilated me.

Pressing the fire button, which controls the jump and flip action, causes the Defender-Droids to flip upside-down and render them harmless. Armed with this technique, I captured more space territory, until I conquered the screen. *Time Runner* plays a cute musical jingle when you complete a screen. I moved to the "Countdown" screen, which is similar to the "Rush" screen but contains bonus points within each space territory. Countdown takes its name from the rapidly decrementing bonus points within a space territory after you trace its third side. I finally managed to complete the Countdown screen; the jingle played, and the "Rush" screen appeared again.

The Options

The three console buttons control the *Time Runner*. The Option button selects either Beginner or Expert mode, the difference being the speed of the *Time Runner* and the

continue to page 17

Jeannie Gutierrez is a freelance writer living in San Jose, California.

Starbowl Football
Gamestar, Inc.
Santa Barbara, CA
400/800 Disk
$31.95

by Steve Harding

The crowd tenses in anticipation as the teams take the field. The National Anthem plays and then the kickoff. It's the Reds against the Blues. Blitz the quarterback! Watch out...it's an end run! First and 10. Hike. The quarterback drops back to pass...he sees an open man downfield... another incomplete pass. Thus begins Gamestar's *Starbowl Football.*

Each game of *Starbowl Football* features twelve players—six on each side. Offensive and defensive plays are entered via the joystick. The offensive quarterback can run or pass. Passes are thrown by pressing the fire button. You have control of one football player, as does your opponent, the quarterback on offense and the free safety on defense. Only the safety can intercept a pass.

The computer always punts on 4th down, unless it is within your 40-yard line. Then you can expect a field goal try. Field goals and punts cannot be blocked.

After each touchdown and field goal, the scoring team kicks off. If you are playing the computer, you can run the ball back no farther than 16 yards (five yards, if it is a punt).

Occasionally, and it seems, randomly, you or your opponent will fumble the ball. In my case, it was usually when I was on a drive and inside the 10-yard line.

According to Gamestar, completing a pass is easy. Sure it is, for the computer, but not for a real-live klutz like me. A "klutz-no-klutz" player option would be nice, especially as a player handicap. Nobody likes to get beaten regularly 50-0.

Steve Harding is West Coast Editor of Hi-Res Magazine.

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I wonder if the writer had access to the game before writing the instructions.

The graphics of *Starbowl Football*, while not the best, are adequate. The playfield scrolls left and right. A scoreboard shows the game score, number of downs and yards to go. At the bottom of the playfield is the game clock and a 30-second clock. You play four 15-minute quarters, and the teams even change sides. At half-time the computer provides musical entertainment. Two types of game-play options are available: "College" and "Pro," with the latter being the faster of the two.

Gamestar's instruction manual can use some improvement. The offensive and defensive plays, for example, are described on different pages of the 16-page manual. This makes it difficult for two players to make their choices within the allotted 30 seconds. If you take more than 30 seconds to make a decision you will be penalized five yards for delay-of-game.

Apparently Gamestar has realized some of the game's shortcomings. They've cranked out a set of mimeographed playing tips. Using these, I got beat 23-17: Much better than the earlier 50-zip pastings the computer was meting out to me.

According to the manual you can stop by pressing the space bar, but you cannot call timeout to stop the game clock after the completion of a play. Instead, you must wait until the teams are in the huddle.

Although *Starbowl Football* adequately represents the game and involves the player in strategy, it's not for the average computer game player. I can only recommend it to someone who understands computers a lot better than he understands football. Given time, however, I'm sure you can become skilled at Gamestar's sport.

Moon Shuttle
DataSoft, Inc.
Chatsworth, CA
400/800 Disk & Cassette
$29.95

by Steve Harding

My mama always said if you can't say anything nice, don't say anything at all. But mama didn't review video games.

Moon Shuttle, from DataSoft, is a copy (under license) of an arcade game produced by Nichibutsu, USA. I'll admit I'm not one who frequents the video game parlors and plunks his quarters into the machines. But if I were, just watching someone play *Moon Shuttle* would send me off looking for *Ms. Pacman* or *Battlezone*.

It bereaves me to give DataSoft a bad mark on a game, especially when I'm sure they have done their best to bring an accurate copy of an arcade game to the Atari marketplace. By and large, DataSoft's games are always fresh and exciting. *Moon Shuttle* opens up brightly enough with an impressive cover illustration on its instruction manual. After that, it's strictly downhill, boys and girls.

We are told how to load the game, how to start the game and how to score the game. The back of the pamphlet gives you some "strategy" tips. It also illustrates some of the objects you are required to "destroy." But they're shown sideways. I wonder if the writer had access to the game before writing the instructions.

As the game opens, you are piloting a spaceship (one assumes it's the shuttle . . . the manual doesn't say) through an asteroid belt. You must destroy those asteroids ahead of you. If you squeeze through the asteroid belt, you will score a bonus, the size of which depends upon the level at which you are playing.

After each attempt at an asteroid belt, you'll be greeted by one of four different types of creatures that are out to destroy you—bomb launchers, expandos, man-o-wars and the dreaded blob men. If you make it through one complete attack cycle, they will start all over again.

So much for *Moon Shuttle*.

One new marketing twist from DataSoft: They're packing both a cassette and disk of their game in the same box. DataSoft's feeling is that someone who initially purchases a cassette will later upgrade to a disk system. Datasoft is doing its part to reduce the software penalty for upgrading your system. Good thinking.

Steve Harding is the West Coast editor of Hi-Res Magazine.

MOON SHUTTLE

Moonshuttle *by Datasoft*

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The Nightmare
Escape from Vulcan's Isle

by Marc Benioff

Epyx/Automated Simulations Inc.
$29.95 each

by Gordon M. Wong

There are other programs on the market that take fuller advantage of the Atari than the following Epyx games. More imaginative software by my standards usually contains a mixture of wrist-wrestling shootouts and drama. The player waits for the computer to make its move. But not these sequels to the well-received *Temple of Apshai* series. In my opinion, strategists are going to dislike these simulated adventure games equally as much as arcaders.

The Nightmare has you awakening in a haunted mansion composed of a dungeon and three upper floors. You must escape this mansion within eight real-time hours or you will die. To escape, you must obtain your Mind's Eye. But, several evil personages are guarding the passages.

Each level of the mansion is represented as a floor plan in which you, as a man-figure, move under joystick control. If you've ever played a graphic adventure from the now defunct Crystal Software, this format will be very familiar. As you scroll across hallways and unlocked rooms on a single floor, only the small portion of the floor, comprising your immediate surroundings, is viewed on the screen at any one time.

To get to another floor, you must move your cursor to a stairway. Bumping into walls or locked doors results in an "OUCH." Each of the rooms are labeled, and their walls are nicely textured with torches mounted on them. The author has done a good job of redefining the character set for his static display.

Two readily found keys are down in the dungeon. With these keys, you can find the locked room that each opens, and retrieve an object and a new key inside that room. Then you must repeat this pattern with your new key. The major difficulty you will have is searching for the right room, since it can be on another floor. Hint: It is best for you to keep a map of each floor, and before too long, you will obtain all the objects necessary to appease the sentries of your Mind's Eye so you can escape. No puzzle-solving abilities are needed in this game.

The game presents very little combat challenge, even to a rank novice. In your quest for objects, you will encounter several roaming tormentors, which are supposed to provide difficulty. In the dungeon, it is a pack of rats, easily avoided by keeping a wall between you and them. On the second level, a psycho in a bathroom comes at you. Beware, for on the third level, a ghost will threaten you. Although it can transverse walls, the spirit makes a late appearance, so if you hurriedly search through the floor, you will find what you are searching for without too much harassment. Except for a locked door, treasures are not guarded.

To escape you must obtain your Mind's Eye But, several evil personages are guarding the passages.

If you choose to fight, rather than run, do not expect arrow-shooting or sword-thrusting animation. All combat here is done with dual random number generators. Yep, much like a slot machine. Just push the button to see how well or poorly you are doing.

The second Epyx program, *Escape from Vulcan's Isle*, is very similar to *The Nightmare*, only the locale is different. You, as a shipwrecked sailor, must collect certain magical items in order to escape from a volcanic isle. Along the way, you will pickup gold pieces to trade for commodities at a forbidden village and thwart the dogged attacks of a man-eating villain, giant Medflies, Satyrs, and guardians of the tombs.

As in the earlier game, you must search in order to find the treasures but it is a bit easier since every item you need to find, with the exception of a magical cloak, is in the same part of the island you are presently scrolling. So, you won't need a map. The four parts of the island, three of them subterranean, can be fully explored and the game finished in less than two hours (the save game feature of both games is unnecessary.) The game ends so suddenly that a player is liable to feel jilted.

The program simply lacks the combat challenge that an adventure game should have. You can very easily outrun your foes, and once your power is built up, these menaces are not much of a challenge.

Both of these games represent the state of the art in Atari computer software...two years ago, when the use of redefined character sets and coarse scrolling techniques were very innovative. Since then, however, the abundance of helpful technical information from Atari Inc., the popular microcomputer literature, and user experiences, has resulted in many more creative game innovations. Concurrently, user expectations have risen.

Among newer expectations is the use of machine language. Both *The Nightmares* and *Escape From Vulcan's Isle* are programmed in Basic. While these two programs eliminate the use of the nuisance keyboard input, found in the earlier Crystalware programs, joystick response is still deadly slow for player movement. The use of machine language would speed up movement routines considerably. Coupled with fine-scrolling techniques, movement across the screen would be less clunky.

In addition, a more extensive use of animation adds interest to these

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Gordon M. Wong is a freelance writer living in Oakland.

The object of the game is to stay alive and capture space territory while avoiding the deadly Defender-Droids.

games. The man symbol, serving as little more than a location cursor, is dull, and the monsters, which are slightly animated, do not look like monsters. Since there are few personalities in the game besides you and one foe, the use of player-missile graphics would be an ideal vehicle for movement animation, as well as spirited combat sequences. Both of these are noticeably lacking.

Even with the above improvements, gameplay is still unprovocative. The difficulty of the games needs to be raised, having goals with more complex solutions. Monsters should be more numerous as well as more intelligent. As is, almost the only challenge comes from trying to read the documentation, which overdoes itself in establishing the mood of the games.

Lastly, these two recent games fortunately lack the program bugs which became inherent in the Crystalware programs. They retain, however, many of the limitations found in an earlier period of the Atari software market. If you are looking for good animated adventure, try Epyx's *Temple of Apshai*, Quality Software's *Ali Baba* or Synapse's *Shamus* instead.

Note: These two games will not load properly if a Newell Industries' Fast Chip is installed in your Atari. If the programs do not run correctly, this may be the cause.

Time Runner
From page 13

Defender-Droids. As expected, I consistently did better in the Beginner mode.

The Select button allows you to choose Direct or the Coast mode. The Coast mode allows the *Time Runner* to continue in the direction of travel, after the joystick has returned to the center position. I find this mode easier for moving the *Time Runner* and less tiresome on my hand.

The Direct mode requires a constant pressure on the joystick for movement, and at times it's difficult to move the *Time Runner* around the corner of a space rectangle.

The Start button, naturally, starts the game. The main drawback of the console buttons is that they take effect only after the Start button is pressed and play has started. Thus, you lose a few moments of play while selecting the different modes.

One feature that I believe all games should have is a Pause option. In *Time Runner* the "ESC" key is used as a Pause so you can answer the telephone, get to the refrigerator, or contemplate your strategy. Press the "ESC" key a second time to resume play—a feature not described in the instruction manual.

My playing *Time Runner* in the expert mode results in low scores and short games. My initial three lives did not last very long with those Defender-Droids hot on my trail. I restored my self-confidence by switching to the Beginner mode and amassing thousands of points. I definitely recommend the Beginner mode for getting the feel of the game and developing strategy. However, I was unable to develop a consistent pattern to follow in either mode in order to capture space territory and avoid the Defender-Droids. I relied strictly on quick reversal-type moves and Lady Luck.

What about skill levels? Yes, they are present in *Time Runner*. After completing several screens I noticed that the Defender-Droids increased in number, from four to seven. Believe me, it tends to get a little crowded out there when trying to capture space territory and six or seven Defender-Droids are in hot pursuit. You can render them harmless (without using the fire-button), but I don't want to leak all the secrets.

The game description is easy to read and easy to understand. The Jump and Flip function is not clearly defined, but that allows for a certain sense of discovery that I find appealing. Now all I have to do is see if I can break the 10,000 point barrier in the Expert mode.

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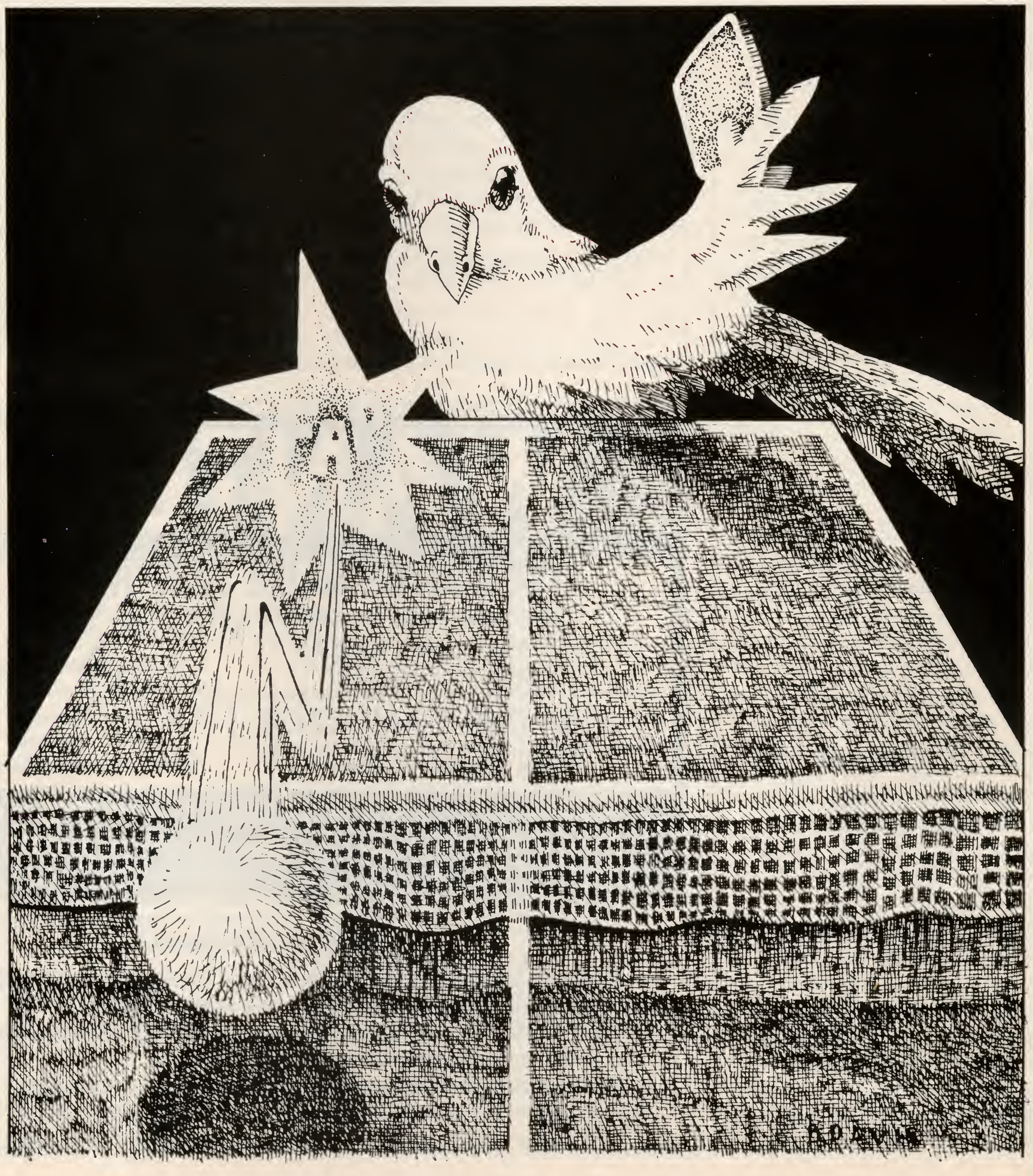


by:
Lloyd R. Prentice

Professor Pavlov taught his dog to salivate...
Dr. Skinner taught his pigeons how to play ping pong

Who should control the learning process—the educator through the medium of the computer? Or the learner? This is one of the major debates in educational computing circles.

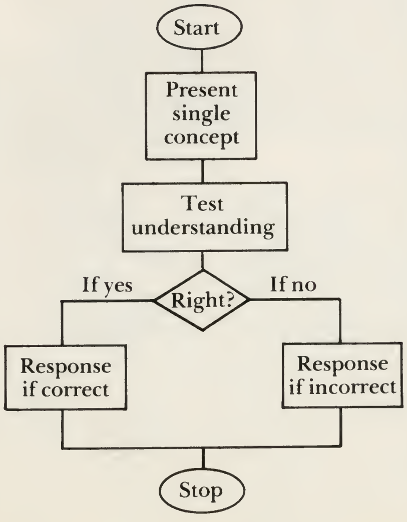
In the late 1950's, researchers at IBM suggested that the computer could be a powerful medium of instruction. At the time, stimulus-response theory (S-R) was the rage among behavioral scientists, S-R, a theory of learning based upon Dr. B.F. Skinner's wartime work with pigeons and, earlier, Professor Pavlov's work with salivating dogs, essentially argues that you can shape, or condition, the response of an organism to a stimulus through timely reward and punishment. Guided by these notions, Professor Pavlov taught his dog to salivate in response to the ringing of a bell, and Dr. Skinner taught his pigeons how to play ping-pong.

Dr. Skinner took the notion a step further by suggesting that the conditioning process could be mechanized, and building a number of mechanical devices to prove his point. This was the beginning of teaching machines.

Based on this theory, the people at IBM suggested that the computer was potentially a much better teaching machine than the difficult-to-program and unreliable mechanical devices of the time. Other researchers at the University of Illinois, Stanford University and elsewhere around the country subsequently accumulated weighty evidence that, indeed, IBM was on the right track. One of the most impressive systems to come out of this work was Control Data Corporation's Plato system, largely developed at the University of Illinois.

This classical computer-assisted instruction (CAI), as exemplified by Plato, is founded upon a simple algorithm. On the Atari, it would take about 10 minutes to develop a simple learning program based upon this system. It looks like Fig. 1.

In theory we know you can dissect the most complex subject into a number of single concepts or ideas. Each of these ideas is embedded into the CAI algorithm, in turn connecting the resulting modules into the proper sequence. Once done, learning can proceed without the intervention of a teacher.



But to evaluate software based upon this algorithm, you need to ask several questions:

- How interesting, clear and concise is the presentation of the idea?
- What, exactly, is being tested and how reliably?
- How appropriate are the responses to both the correct and the incorrect cases?

The bottom line is: who learns what, how well and how quickly?

All of this brings us to the subject of this month's review: Dorsett Educational Systems, Inc.

Located in Norman, Oklahoma, Dorsett has developed 28 self-study courses for presentation on the Atari 400 and 800 with cassette player and educational cartridge. The courses range from Algebra to World History. They include such diverse topics as Construction, Digital Electronics, Philosophy and Spanish/English. Each course comprises 16 programs and costs $79. A program cassette consists of approximately 40 frames, or units of information. You can buy any of these cassettes for $9.90.

Each program in the Dorsett series follows the same format. When you begin the tape, a pleasant voice with a Midwestern drawl narrates the lesson. If you are working your way through program three of the physics course, for instance, you would hear the following:

"We've already learned that the kinetic energy possessed by a moving mass is equal to one-half the mass times the velocity squared.

Continue to 61

Lloyd R. Prentice heads Prentice Associates, Inc., software and book developer for major publishers. He was the founding editor of Classroom Computer News.

SURVIVAL
SEA DRAGON

Survival
In Wonderland
by Dan Horn

Strolling through the Wonderland of computer games I've discovered that, all in all, the games win. There's always that one level that you can't get by or that one screen that you've heard about but have never seen.

Well, one magical day, I chanced to pass through the Looking Glass of games into a world of secret doors and false walls. My journey into Wonderland seemed far more interesting than Alice's.

Late one bleary-eyed evening as I ambled past all those games relegated to the shelf because they were simply too hard or too frustrating, I met a White Rabbit with a pocket calculator. But this time he wasn't running late, and he invited me to step into the Looking Glass and share with him some interesting secrets.

As we walked together, a small man wearing sooty overalls and a miner's helmet dashed by. He was jumping with odd little leaps as he ran, and was being pursued by some rather ugly mutants. Mr. R., taking note of this unusual spectacle, called after the man in some sort of arcane-sounding language. With scarcely a pause, the little man rocketed from his simple, introductory game level to an advanced one. The score counter began ticking wildly—the points were racking up faster than Mr. R. could tally on his calculator.

Aha! I thought. *A sterling opportunity to extract forbidden knowledge from the venerable Mr. R.* I asked my furry companion what he had said to the little man. "Listen and learn, my boy," Mr. R. said, his nose and whiskers syncopating perfectly. "I told him to type the phone number from the title screen after he had reached a safe place. Once there, a simple press of the Shift key followed by any of the level numbers will whisk one to that level!"

A kaleidoscopic shimmer marked our passage into yet another weirdling nook of Wonderland. Even before the mist had cleared, I could feel the excitement—the air was electric with the spirit of Adventure, and as far as the eye could see, the strange meshed with the not-so-strange. Bears, salt, hurricanes and logs, it was almost too much to believe. At first glance, there appeared to be little logic to the bizarre panorama—the bear *had* to be dealt with, but long before one could solve the problem, one would be swept away by the hurricane. Mr. R. offered a solution. "Say 'Yoho,'" he said, "and then save the game onto your tape or disk." Once saved, you can outwit those troublesome random numbers and continue until you do!"

Again, the wisdom of Mr. R. shattered what many had thought to be an impenetrable game barrier. My excitement was escalating now—I couldn't wait to see if Scott Adams' *Savage Island-Part I* could be skinned and hung in my trophy room.

I had just turned to ask Mr. R. to reveal more secrets to the Adams' Adventures, when he produced a gold pocket watch with a flashing LED display and starred at in shock. "I'm late!" he cried. "Fare thee well and the best of all things to you!" As quick as a wink, he vanished into a wispy neon swirl of light.

His words were still ringing in my ear when a vast sea of sand appeared before me. Distant spires poked into a pristine, azure sky, recalling childhood tales of *Ali Baba and the Forty Thieves.* I followed a trail of time-worn cobblestones, and soon found myself inside of another classic game. Secreted somewhere in this arid desolation was the beautiful (natch!) princess. Less well hidden were the many foes that would just as soon draw a scimitar across one's throat as to look at him.

A sudden tap on my shoulder made me whirl like a dervish and come face-to-chest with a small turbaned boy. I started to speak, but he applied a dark index finger to his lips, whispering. "A secret for you, Sahib." His eyes darted to and fro, as if searching for eavesdroppers. "Try adding a player when facing a tough opponent. Let this extra player fight for you. Once he tangles with the monster, run like all the jackels of the Sahara are nipping at your heels. This will provide a means of escape, and as long as you remain alive, the game will continue." Deceptively simple, I thought, but a hint in the truest sense. Upon my return from Wonderland, this information would revitalize a game long since retired to the shelf.

I soon returned to the sand-strewn cobblestone path, where it quickly led me smack into a huge pyramid. The entrance appeared to be unguarded, so I stepped inside. To my surprise, a large set of teeth glowed in the tar-black darkness of the stone passage. My eyes adjusted quickly, and I discovered that the grin was owned by a rather large cat that floated aside a man dressed in khaki shorts and a pith helmet. "No matter how hard I try, I can't seem to get to the upper levels of this bloody pyramid!" the man shouted with no small degree of exasperation.

"Calm down," the floating cat

Dan Horn is an adventure enthusiast working at Infocom in Cambridge, Massachusetts. He is a regular contributor to Hi-Res.

soothed. "All you have to do is finish the first level. When the code word to the next level appears, press the Reset key. Strange as it may seem, this will cause the codeword for the next level to flash. Continue to press the Reset key and the codewords to all of the upper levels will flash." The cat was starting to fade now. Within seconds, all that remained was its toothy grin. "You'll never find an easier way to reach the top level!" it cajoled with a raspy purr, and disappeared completely. Armed with this knowledge, the man ran gleefully down the passage and into the dark of the tunnel. *Pharoah's Curse* now had a little less sand in the works, and playing those upper levels would make the game much more fun.

I stepped from inside the pyramid into the searing desert heat. After trudging through the dunes and drifts for a while, it occurred to me that it had been some time since I had quaffed a cool one. Fortunately, the magic of Wonderland soon provided a welcome break in the sandy scenery: a shaded, beachside villa suddenly fell into focus with startling suddenness.

I approached the villa and knocked on the door, and was greeted by a Carpenter and Walrus who ushered me inside. They bickered constantly—something about the pros and cons of harvesting oysters by submarine. As we chatted over drinks and pimiento dip, I learned that they had discovered a tablet which revealed the secrets of undersea travel, plus a few special commands that were not included in their sub's instruction manual.

We clambered into their sturdy sub, the *Sea Dragon*, and I tried my darndest to remember where I had heard that name before. But before my memory could jog, they had plugged in their joysticks and we submerged in a foam of bubbles and departed for the well-protected oyster beds that lay to the south.

The passage to oyster Nirvana was a jagged tunnel which snaked through a smorgasbord of tethered mines and descending depth charges. The *Sea Dragon* was heading directly for a volatile-looking mine. Just when I figured that the Carpenter would slap the joystick trigger button and blast the mine into a thousand little minelettes, he instead pulled the joystick plug from port one and popped it into port four. A press of the trigger button and—*voila!*—the mines were replaced with a shower of depth charges. Again, the Carpenter pressed the trigger button, transporting us to yet another scene. This time, the walls of the tunnel were much closer and it was a claustrophobic squeeze through the maze.

While I chewed a few fingernails, the Walrus, non-plussed, was sipping grog through a straw and leaning lazily on his joystick.

About this time, I noticed that the air timer had zeroed out. Before you could say "scuba," the *Sea Dragon* exploded into a million tiny fragments. As we floated on the debris, the topic of navagation came up several times. But the Walrus, unflappable to a fault, simply plugged a joystick into port three of an Atari 800 that happened to be drifting past, and pushed the trigger button. Instantly, we were back in the *Sea Dragon*. I glanced at the master screen: a strange symbol had replaced the miniature sub figures on the Remaining Subs display. I inquired about this anomaly, and was told that the mystery graphic signified that five additional subs had been awarded. "We can crash all the livelong day!" the Carpenter cried as he merrily steered the *Sea Dragon* toward a descending depth charge.

Just as a deafening explosion ripped the air, spraying my back with sea water and bits of soda straw, I stepped through the Looking Glass and stepped back into the Here and Now. My den seemed a bit out of place considering the sights and events I had witnessed on my wonderous journey, but the sight of my waiting Atari quickly galvanized me into action. I grabbed a dusty *Miner 2049er* cartridge from the shelf, wiped it on my pantsleg and inserted it into the waiting slot. And as the opening sounds of play began, I paused for a moment to wonder: Does Alice ever play computer games?

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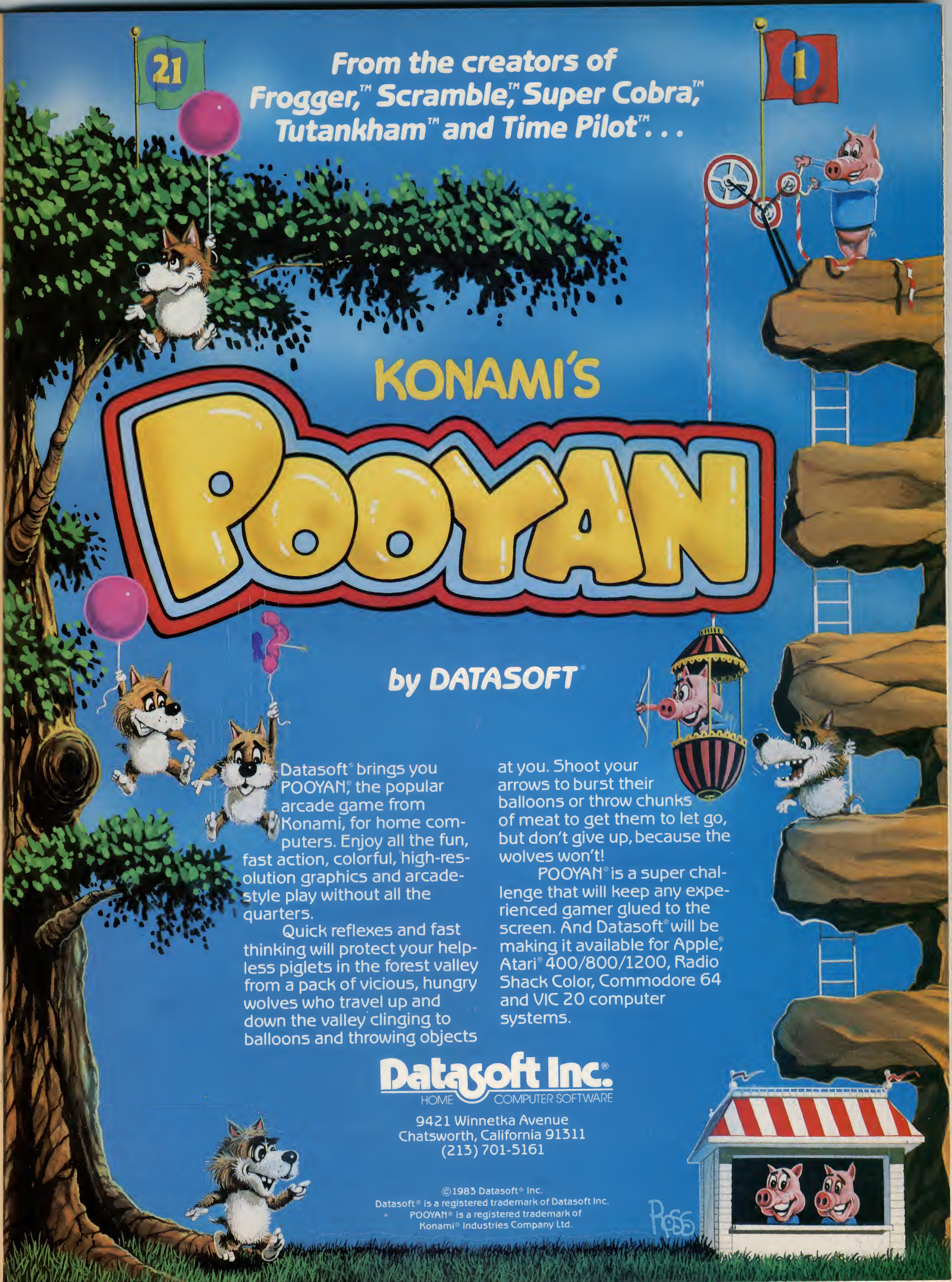

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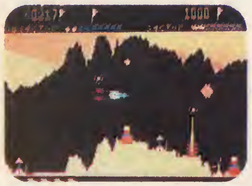

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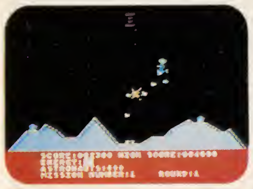

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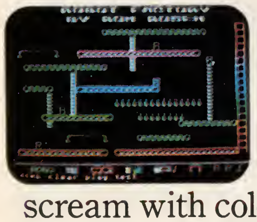

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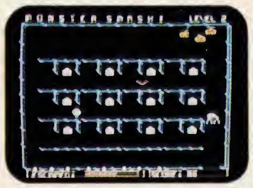

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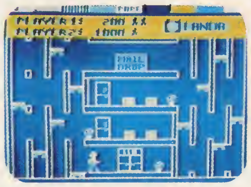

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NUMBER MAZE

by Sol Guber

Number Maze is a joystick game of calculation and speed. But instead of rooms and walls, you must find an open path through a maze of numbers using mathematical rules.

In each of sixteen rows are twelve numbers. The object of the game is to move the flickering cursor from the upper left-hand corner to the highlighted number in the bottom row. The cursor moves to another number, only if the move follows one of the mathematical rules for adding, subtracting, multiplying or dividing by a factor. As the cursor moves, the numbers are highlighted, while a clock in the lower right corner records your elapsed time.

You can restart if you wish; or, if you really get frustrated, the computer will show you the solution and you can begin a new game. Fig. 1 shows you a typical maze. Its factors are +1, +2, −1, −2.

Your answers to a series of questions at the beginning of each game make the maze easier or harder. The first question asks if you wish to use your own number factors for the mathematics problems in the maze. Factors must be greater than zero and less than ten. If you wish, the computer will select random numbers between one and nine.

The second question asks if you want to use multiplication and division factors. The third question asks if the maze is to be one way. In a one-way maze, you cannot go back to a previous position, unless the factoring rules allow it. A one-way maze is very hard.

If you wish to use your own factors, the computer asks first for the addition factors, then for the subtraction factors, and finally for the multiplication and division factors. When you enter your own factors, the computer will not ask about a one-way maze.

If you type a letter in answer to a question, or your answer is not allowed, the questions start over. If you use your own factors, then you can use the same number twice. The higher the numbers used for the factors, the more difficult the maze game. For the easiest maze, use small numbers like one and two, and make the maze two way so that there is a return path.

Example of Play

Let me explain the game using addition and subtraction rules as follows: +4, +5, −2 and −5. Suppose that a position square contains the number 45. The legal moves are to a position containing one of these numbers: 49 (+4), 50 (+5), 43 (−2), or 40 (−5). If the surrounding positions do not contain one of these numbers, then you have lost your way

---

Sol Guber is an engineer who has been programming his Atari for about two years. He's taught both beginning and advanced Basic classes.

The object of the game is to move the flickering cursor from the upper left-hand corner to the highlighted number in the bottom row.

86	78	79	80	81	79	23	06	12	47	15	50
84	79	80	31	54	77	20	45	14	07	91	18
85	83	81	75	43	76	12	79	89	94	29	01
34	35	78	76	75	77	70	85	51	23	33	83
73	19	76	77	03	73	91	52	27	11	25	51
63	47	45	76	75	42	52	27	11	43	37	73
10	81	99	78	74	76	77	50	43	52	76	36
48	22	21	44	07	81	76	96	52	78	79	77
77	87	11	39	10	52	74	76	78	76	77	76
42	35	68	85	67	00	10	01	76	32	44	78
16	25	31	34	34	41	55	78	32	25	45	80
61	36	02	70	56	80	80	17	25	81	83	79
24	61	25	98	25	79	69	13	81	83	82	80
00	10	37	64	70	78	21	14	83	81	36	06
51	50	01	99	47	25	76	91	82	83	23	12
43	59	53	78	29	89	46	25	84	97	28	69

Fig. 1. A simple-two way maze in which the addition and subtraction factors are equal.

in the maze. If a surrounding position contains the number 50, then you can move the joystick in that direction. The number 50 becomes highlighted.

Your next possible move is to a position containing either 54 (+4), 55 (+5), 48 (−2), 45 (−5). Again, if the position above or below or to the sides of your present position does not contain one of these numbers, then you are lost in the maze.

You can move the joystick horizontally or vertically, but not diagonally. And you can't score in this game; you can only beat your previous time.

In one-way mazes, you can become stuck. Sometimes you can't make any legal moves. If you don't move for about 30 seconds, then the computer starts asking questions on the bottom of the screen. The first question asks if you need any help. A "Y" or "N" will be highlighted and the cursor moves from one to the other. Use your joystick to answer the questions. Press the trigger when your answer is highlighted. If you answer N to the help question, then the maze continues with no clock change. If you answer Y, then the computer redraws the maze and the cursor returns to the upper left corner. The clock is put back to zero.

If you answer N, then the computer asks if you want the solution. If so, the computer gives you the solution. If you didn't want the solution then the questions start over. You can start a new game after the computer reveals the solution.

To make the puzzle easier, try creating a two-way maze. To do this, make the subtraction factors the opposite of the addition factors- and make the multiplication factors the inverse of the division factors. Now you can move through the maze backwards.

If you design a one-way maze, your moves must be well thought out to be sure that you are on the correct path. The higher the factors, the more difficult the maze.

The computer can generate a very complicated maze by using all four types of factors—additions, subtraction, multiplication and division. Since all the numbers must be less than 100, the multiplication and division factors are used less often than the addition and subtraction factors.

If you make an error while entering your own factors, you can enter a letter rather than a number. This causes the questions to repeat, and you can correct your entries.

```
0 GOSUB 12000:REM NUMBER MAZE     by SO
L GUBER   Rev. 0.0   10/82
1 GRAPHICS 0:C1=1:C2=2:C3=3:C0=0:C50=5
0:C16=16:C10=10:C256=C16*C16:C6=6:C8=8
2 C65=65:C26=26:MAKER=8000:TER=8800:C1
7=C16+C1:C4=C2+C2:C3=C4-C1:C12=12:C192
=192:C40=40
3 C20=20:C128=128:C64=64:C15=C16-C1:CL
OCK=3000:FINISH=4000:C60=60:C5=5:C7=7
5 DIM A$(200),B$(50),MAZE$(278),F(8)
6 DIM XSTEP(16),YSTEP(16),MK(4),MA$(27
8)
8 MAZE$(C1)="":MAZE$(278)="":MAZE$(C2)
=MAZE$
10 GOSUB 6000:TRAP 40000
12 MK(C1)=-C1:MK(C2)=C12:MK(C1+C2)=C1:
MK(C2+C2)=-C12:C90=90:C91=91:C99=100
15 M=INT(RND(0)*25)*4+1000
18 MA$(C1)="":MA$(278)="":MA$(C2)=MA$
20 RESTORE M
30 READ L1,A$
31 DL=PEEK(560)+256*PEEK(561)+5
32 ? "}":? "  PLEASE WAIT A        MINU
TE"
35 POKE DL+1,7:POKE DL+2,7:POKE DL+3,5
:POKE DL+4,5:POKE DL+5,5:? "NUMBER MAZ
E"
40 IF L1>100 THEN READ B$:A$(101)=B$
41 R=ADR(A$)
42 FOR I=R TO R+L1-C1:POKE I,PEEK(I)-C
50:NEXT I
45 L=1:LT=INT(RND(0)*100)
50 FOR I=R TO R+L1-C1:NUM=PEEK(I)
55 IF NUM>16 THEN L=L+NUM-C16:GOTO 70
60 MAZE$(L,L)=CHR$(NUM):MA$(L,L)=CHR$(
NUM):L=L+C1
70 NEXT I
72 GOSUB 500
75 GOSUB MAKER
78 R=ADR(MAZE$)
80 FOR I=R TO R+C192:IF PEEK(I)=C0 THE
N POKE I,INT(RND(0)*C99)
85 POKE 710,I-R
90 NEXT I
100 GRAPHICS 0:?
103 POKE 703,4:POKE 752,1
```

Number Maze

```
105 SETCOLOR 2,12,2:SETCOLOR 4,0,0
110 FOR I=C0 TO C16-C1
115 FOR J=C1 TO C12
118 P1=ASC(MAZE$(J+C12*I))
120 ? #6;" ";:IF P1<C10 THEN ? #6;" ";
122 ? #6;P1;:NEXT J:? #6;"  ";:NEXT I
128 LR=PEEK(83)-PEEK(82)+C1
130 I=LEN(A$):ED=C12
132 R=ASC(A$(I,I))
134 IF R=C2 THEN 140
136 IF R<C16 THEN ED=ED-1:I=I-C1:GOTO
132
138 ED=ED-R+C16:I=I-C1:GOTO 132
140 SC=PEEK(88)+C256*PEEK(89)
141 X=C1:Y=C2:POKE 18,C0:POKE 19,C0:PO
KE 20,C0:GOSUB 600
145 PT=SC+LR*C16+LR+ED*C3-C4-C1
148 POKE PT,PEEK(PT)+C128:POKE PT-C1,P
EEK(PT-C1)+C128
150 POKE SC+43,PEEK(SC+43)+C128
151 POKE SC+42,PEEK(SC+42)+C128
152 POKE SC+44,PEEK(SC+44)+C128
155 GOSUB 900
158 MZ=C1
160 LT=ASC(MAZE$(MZ,MZ))
170 ED=ED+C1
270 M5=SC+C40*X+(Y-C1)*C3
280 S=STICK(0)
288 NG=C128:IF PEEK(M5)>C128 OR PEEK(M
5+C1)>C128 THEN NG=-C128
290 IF S=C15 THEN POKE M5,PEEK(M5)+NG:
FOR Q3=C1 TO C26:NEXT Q3:POKE M5,PEEK(
M5)-NG:GOTO 370
292 SOUND C0,X*C16,C10,C10:SOUND C1,Y*
C16,C10,C10:FOR I=C1 TO C16:NEXT I:SOU
ND C0,C0,C0,C0:SOUND C1,C0,C0,C0
300 X=X+XSTEP(S):Y=Y+YSTEP(S)
305 IF X<C1 OR X>C16 THEN X=X-XSTEP(S)
:Y=Y-YSTEP(S)
310 IF Y<C1 OR Y>C12+C1 THEN Y=Y-YSTEP
(S):X=X-XSTEP(S)
315 M5=SC+C40*X+(Y-C1)*C3
320 L1=ASC(MAZE$((X-C1)*C12+Y-C1))
330 FLG=C0
340 FOR I=C1 TO C4:IF L1-LT=F(I) THEN
FLG=C1
342 NEXT I:IF FG1=C0 THEN 350
344 IF LT*F(C5)=L1 OR LT*F(C6)=L1 THEN
 FLG=C1
346 IF LT/F(C7)=L1 OR LT/F(C8)=L1 THEN
 FLG=C1
350 IF FLG=C0 THEN X=X-XSTEP(S):Y=Y-YS
TEP(S):M5=SC+C40*X+(Y-C1)*C3:GOTO 400
355 M5=SC+C40*X+(Y-C1)*C3
360 LT=L1:IF PEEK(M5)<C128 THEN POKE M
5,PEEK(M5)+C128:POKE M5-C1,PEEK(M5-C1)
+C128:POKE M5+C1,PEEK(M5+C1)+C128
370 IF X=C16 AND Y=ED THEN GOTO 4045
400 GOSUB CLOCK:GOTO 280
499 STOP
500 P=0
510 RETURN
600 ? "}     +";F(1);"   +";F(2);:IF F
G1=C1 THEN ? "      *";F(5);"            *";
F(6)
620 ? :? "     -";INT(-F(3));"  -";IN
T(-F(4));:IF FG1=C1 THEN ? "      /";
F(7);"     /";F(8);
630 RETURN
900 FOR I=C1 TO C16:XSTEP(I)=C0:YSTEP(
I)=C0:NEXT I
910 XSTEP(14)=-C1:YSTEP(7)=+C1
920 XSTEP(13)=+C1:YSTEP(11)=-C1
930 RETURN
1000 DATA 112,4F55554D4F6E55454E6F43C5
5556E43C434343D43D463636334E4C5545464E
4C6C46564E546436333F5655554M54M4K433K5
1002 DATA 4K433G43333H
1004 DATA 80,54L43L4M4M454K5654H54E4E5
4C64E4E65464D43C556C564D4546G4D5656G4K
433K4M554K433J43D
1008 DATA 55,554L43K43L4M4M4554J56C555
54M54L43K43L54L43L4M4K434K463G
1012 DATA 96,54C554I54643J465554H56E4C
554I55643H433354H554634J5463I43354G433
C564G5454643H565654K433K554L43L54
1016 DATA 85,4M4M4M4M4M54M4E55454E4E63
5654D54E6E54C43C556F4C55564343333E4336
554E434D6333E463K4L43L
1020 DATA 80,4M5554K434J4364J4C654I4C6
43I4C63554G4E643E54555565545564I56434K
463K54M4M4M54K433
1024 DATA 98,4554J5643L4M4M4M4G54F4C55
5464D433C6D464D54556D56554C4633E4333C5
556E4554I436C4I54634I43564I55643L54
1028 DATA 64,4M4M4M5554J4333J4M54M5454
54I465654H56D43L4M4M4L43I43C54G4336333
G
1032 DATA 58,5555554M54L43L555454K564K
434K463K554L43L54L43L4M54M4M4K433
1036 DATA 115,454K46554I5643554I46333G
4335554G4556433G464354H4646C54G4646333
G564C554G43356C554E55463D43E43556433F4
```

"Tough luck, Pal. Computer error or not you'll find a change of clothes in locker 6."

```
1038 DATA 63343H54C63J54K
1040 DATA 91,54554E54544363555556564554
6F4334D56E43C64H43D63H4J4333J454K464K5
64M4K434K463J43C54I555654M4F
1044 DATA 102,5545555555554433643334333
4C564D64C54556C4D63564F554546C4H565643
G4333354G4554633G56C4M5554M4M4L43L54M4
1046 DATA M4
1048 DATA 94,4D54I5556454K464K464J4365
4C554E556C54643J464K5654M4M4K434G43333
64F43E56443343F633546554I46333H
1052 DATA 77,5555555554L43L4K433K5554L
43H43343I5463J43J433K54J4333J4E554G4D5
643G5556C4M54G
1056 DATA 64,455554H463D4H556D4J4333J5
4M54M554M555454K564M4M4K434K463K4L43L4
E
1060 DATA 126,4D55554F5456E54E4363F4C5
4454633D4C64564C56D5564D556C433C43H4C6
33G433G43333I4555454E5456D4654D64F56C5
1062 DATA 5564I43343H43C64I54C63I43F
1064 DATA 82,554C54C554F55655643H43334
I4D63H43L54M5455554H56D43L454K564H4333
33H55554L43L554M4M4
1068 DATA 83,4D54C54F455645654E56D56D4
M554K433K4L43J434K463554H5556C4M4M54H4
33D4F433C6333F4M554G
1072 DATA 72,54M5554L43L55554L43D54G43
C5564G4D6D4G54C63C4H554643J5654M4K433K
554M4M4M4
1076 DATA 76,4D54I54C64J55654M5554L43L
554L43L5554J4334J4C64J4C63I43K43D54H54
C564I556C4L43
1080 DATA 46,554L43L454K5654L43L4M54M5
554M4M4M4M54M4M4M4M4E
1084 DATA 64,554K433K54L43L4M4M54L43J5
4455555554564 56H56C4L43J434K463K4M54M4
D
1088 DATA 47,55554M54M4M4M54M454K564M4
M4M4M4M54M4L43L5554L43
1092 DATA 111,4M4H54E4H64E545555564E43
6333D4E4D5564354D54C6434634D4356463C63
D456C4I56D54I4333454G5546364I554654J56
1094 DATA C454K5654M4
1096 DATA 78,55455555554C4336434343 3C4
D646363E555654K433K4M4J4343J463K4M4M54
M5554L43L54L43I
3000 S1=C256*C256*PEEK(18)+C256*PEEK(1
9)+PEEK(20)
3005 IF MOLD<>M5 THEN MOLD=M5:MINOLD=(
S1/C60)
3010 SEC=INT(S1/C60)
3020 MIN=INT(SEC/C60)
3025 SEC=SEC-MIN*C60
3030 POSITION 26,18:? #6;MIN;":";SEC;"
 "
3040 IF MOLD=M5 AND (S1/C60)-MINOLD>C2
6 THEN GOTO 3200
3090 RETURN
3200 SOUND C0,C0,C0,C0:SOUND C1,C0,C0,
C0
3203 T1=PEEK(18):T2=PEEK(19):T3=PEEK(2
0)
3205 ? :? "}DO YOU NEED HELP":GOSUB 50
00
3210 IF BS<>57 THEN GOSUB 600:MOLD=C0:
POKE 18,T1:POKE 19,T2:POKE 20,T3:GOTO
280
3320 ? "}DO YOU WANT TO START OVER":GO
SUB 5000:IF BS=57 THEN GOTO 100
3330 ? "}DO YOU WANT TO SEE THE SOLUTI
ON":GOSUB 5000:IF BS=57 THEN GOTO 3500
3340 GOTO 3200
3500 GRAPHICS 0:?
3503 POKE 703,4:POKE 752,1
3505 SETCOLOR 2,12,2:SETCOLOR 4,0,0
3510 FOR I=C0 TO C16-C1
3515 FOR J=C1 TO C12
3518 P1=ASC(MAZE$(J+C12*I))
3520 ? #6;" ";:IF P1<C10 THEN ? #6;" "
;
3522 ? #6;P1;:NEXT J:? #6;"  ";:NEXT I
3530 GOSUB 600
3534 ED=ED-C1
3540 SC=PEEK(88)+C256*PEEK(89)
3541 X=C1:Y=C1
3545 PT=SC+C40*C16+ED*C3
3546 POKE PT+1,PEEK(PT+1)+C128
3548 POKE PT,PEEK(PT)+C128:LT=PEEK(PT)
3550 POKE SC+43,PEEK(SC+43)+C128
3555 POKE SC+44,PEEK(SC+44)+C128
3560 R=C1
3570 I=ASC(MA$(R,R))
3575 R1=R
3580 R=R+MK(I)
3590 IF I=C1 THEN X=X-C1
3600 IF I=C2 THEN Y=Y+C1
3610 IF I=C3 THEN X=X+C1
3620 IF I=C4 THEN Y=Y-C1
3630 PY=SC+Y*C40+X*C3
3640 POKE PY,PEEK(PY)+C128
3645 POKE PY-1,PEEK(PY-1)+C128
```

Listing Continues

"You're talking software and I'm talking dedicated communications software."

```
3648 POKE PY+1,PEEK(PY+1)+C128
3650 IF PY=PT THEN 4050
3655 FOR MR=C1 TO C64+C16:NEXT MR
3658 TRAP 4050
3660 GOTO 3570
4000 REM
4010 DATA 104,104,104,72,162,57,160,0,
173,0,210,101,20,141,23,208
4020 DATA 141,10,212,136,208,242,202,2
08,237,104,56,233,1,208,228,96,0,0,0
4030 RESTORE 4010
4040 FOR M=1536 TO 1536+32:READ A:POKE
 M,A:NEXT M:RETURN
4045 ? " YOU WON"
4050 M=USR(1536,15)
4060 ? "}DO YOU WANT ANOTHER GAME (Y/N
)"
4070 INPUT A$:IF A$(1,1)<>"Y" THEN STO
P
4080 GOTO 8
5000 ? "Y or N":W=5
5005 Z=SC+842
5010 Z=Z+W:POKE Z,PEEK(Z)+C128
5015 FOR I3=C1 TO 50:NEXT I3
5020 IF STRIG(0)=0 THEN BS=PEEK(Z)-C12
8:RETURN
5030 IF STICK(0)<>15 THEN W=-W:POKE Z,
PEEK(Z)-C128:GOTO 5010
5050 GOTO 5020
6000 TRAP 6000
6002 GRAPHICS C0:FLG=C0:? "DO YOU WISH
 TO USE YOUR OWN FACTORS":INPUT B$:IF
B$(1,1)="Y" THEN FLG=C1
6005 FG1=C0:? "DO YOU WISH MULTIPLICAT
ION AND          DIVISION":INPUT B$:IF B
$="Y" THEN FG1=C1
6008 IF FLG=C0 THEN 6500
6010 ? "INPUT THE TWO ADDITION FACTORS
":INPUT X,Y
6012 F(1)=X:F(2)=Y
6020 IF X>10 OR Y>10 THEN 6010
6030 F(1)=X:F(2)=Y
6040 ? "INPUT THE TWO SUBTRACTION FACT
ORS":INPUT X,Y
6050 IF X>10 OR Y>10 THEN 6040
6060 F(3)=-X:F(4)=-Y
6065 IF FG1=C0 THEN RETURN
6070 ? "INPUT THE TWO MULTIPLATION FAC
TORS":INPUT X,Y
6080 IF X>10 OR Y>10 THEN 6070
6090 F(5)=X:F(6)=Y
6100 ? "INPUT THE TWO DIVISION FACTORS
":INPUT X,Y
6110 IF X>10 OR Y>10 THEN 6100
6120 F(7)=X:F(8)=Y:RETURN
6500 X=INT(RND(0)*9+1)
6505 Y=INT(RND(0)*9+1)
6510 IF X=Y THEN 6500
6512 F(1)=X:F(2)=Y
6515 ? "DO YOU WISH TO BE ABLE TO GO I
N       REVERSE":INPUT B$
6520 IF B$="Y" THEN 6570
6550 X=INT(RND(0)*9+1)
6555 Y=INT(RND(0)*9+1)
6560 IF X=Y THEN 6500
6570 F(3)=-X:F(4)=-Y
6580 IF FG1=C0 THEN RETURN
6590 X=INT(RND(0)*9+1)
6600 Y=INT(RND(0)*9+1)
6610 IF X=Y THEN 6600
6620 F(5)=X:F(6)=Y
6630 IF B$="Y" THEN 6680
6640 X=INT(RND(0)*9+1)
6650 Y=INT(RND(0)*9+1)
6670 IF X=Y THEN 6650
6680 F(7)=X:F(8)=Y:RETURN
8000 I=ADR(MAZE$):DNE=I
8003 F1=C4+C4*(FG1=C1)
8005 Z=PEEK(I)
8008 SOUND C0,I-DNE,C10,C10:POKE 710,I
-DNE
8010 X=INT(RND(0)*F1+C1)
8015 IF X>C6 THEN L1=LT/F(X):GOTO 8020
8018 IF X>C4 THEN L1=LT*F(X):GOTO 8020
8019 L1=LT+F(X)
8020 IF L1<C0 OR L1>=C99 THEN 8010
8025 IF L1<>INT(L1) THEN 8010
8030 LT=L1:POKE I,LT:I=I+MK(Z)
8040 IF I<DNE+C192 THEN 8005
8045 SOUND C0,C0,C0,C0
8050 RETURN
12000 GOSUB 4000
12010 GRAPHICS 18:? #6:? #6:? #6;"
number maze"
12020 ? #6:? #6;"       rev 1.0"
12030 ? #6:? #6:? #6;" (C) Sol Guber":
FOR M=1 TO 750:NEXT M
12040 M=USR(1536,10):RETURN
```

ALLAN K. JENSEN

"I served as my own defense lawyer — the trouble was that I had a lousy programmer!"

Your ship has just come in.

Aboard the S.S. Slipshod, things are getting a little out of hand.

It seems that the navigator mistook an iceberg for Pittsburgh. With predictable results.

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And besides, the game won't let him.

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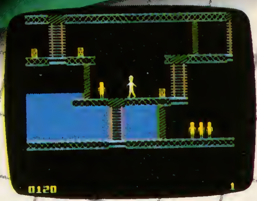

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OH THOSE ?$*& ERROR MESSAGES

PART 2

BY STEVE HARDING

Last issue I discussed error codes generated by Basic. This installment will show you some of the error codes that can be generated when using a peripheral device, such as a printer, a disk drive, or program recorder.

Remember that when an error code is generated, your Atari Home Computer stores it at decimal location 195. Generally, the error code number will remain in location 195 until a new error occurs. With this information, you can use traps to branch your Basic program when errors occur.

Error Code 19: Load Program Too Long

Your computer is telling you that the program being loaded is too large for available memory. If you are sure that you have enough memory in your machine, try resetting the memory modules.

Error Code 20: Device Number Larger Than 7 or Equal to 0

You have tried to specify a peripheral device that your computer is not prepared to handle. Generally, the Atari will not accept a peripheral device numbered larger than seven or less than or equal to zero. For instance: Open #9,8,0,"D:. . ." will give you Error Code 20.

Error Code 21: Load File Error

Read the Atari Basic Reference Manual for definitions of the Basic commands Load and Enter. This error code is telling you that you tried to load a Basic program that was "untokenized" (Listed to the disk drive instead of saved). If you get an Error Code 21 when you type Load

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Steve Harding is West Coast Editor of Hi-Res Magazine.

If you are sure that you have enough memory in your machine, try resetting the memory modules.

"D:Filename" then try Enter "D:Filename".

This error also occurs if you try to load a file that is written in machine language. If you try to enter that file, you will get a different error.

There are no Basic or peripheral-generated error code numbers between 21 and 128.

Many of the following errors refer to the use of IOCBs. IOCB is an acronym for Input/Output Control Block. The IOCB number notifies your computer that you are planning an I/O operation and will use a particular buffer (previously specified by Atari Basic.

Error Code 128: Break Abort

This error code shows up when you press the break key when using Save, Load, List, Enter, or using any of the File Management commands from the Disk Operating System. Your computer is telling you (as if you didn't know) that you have pressed the Break key.

Error Code 129: IOCB Already Open

Now we are getting into the meaty peripheral device error codes. A Code 129 is telling you that you are attempting to open an IOCB that is already open. Perhaps you have opened a file at the beginning of a For/Next loop and at the next reiteration your computer has attempted to open it again.

Or, you have opened a file using one IOCB and are now attempting to open a second file using the same IOCB.

This error can be trapped and used in your program.

Error Code 130: Nonexistent Device Specified

Each peripheral device that you hang on your Atari needs a program called a handler. Some handlers are contained within the computer's operating system, such as the program recorder handler and the printer handler. Others must be supplied to the computer. (The handler for the Atari 850 Interface Module is downloaded from the Atari 850 Interface Module by the AUTORUN.SYS file contained on the DOS 2 Master Diskette.)

With Error Code 130, your computer is telling you that you have attempted to open a peripheral device that contains no handler.

This error code will also occur if you attempt to open a file without specifying a device, such as Open "Filename, instead of Open "D:Filename"

Error Code 131: IOCB Write-Only

Somewhere in your program there is a statement something like: Open #1,8,0,"D:..." Somewhere else (such as where your Error 131 happened) there is a statement something like: Input #1, or Get #1...

In the first statement, you have told your computer that you want to open IOCB #1 for write only I/O. In the second statement, you have attempted to read data from that IOCB, and your computer has rejected that plan.

This error can be corrected by changing either your Open statement or changing Input or Get to Print or Put.

Error Code 132: Invalid Command

There is a portion of the Atari Operating System called the Central Input/Output (CIO) subsystem. It is the CIO's job to handle I/O. When your computer is given an I/O command, a number is sent to the CIO. If the number is less than or equal to two, then this error code is generated.

If the number is between three and 13, then it is a standard I/O command. If it is more than 13, it is a special command. If the CIO tries to process a special command and the peripheral device doesn't recognize it, this also will generate an Error 132.

These CIO command numbers are the same as the Basic XIO command numbers, which are explained more fully in the Atari Disk Operating System Reference Manual.

Error Code 133: Device or File Not Open

Your computer is telling you that you are trying to write or read to a file or peripheral device you have failed to Open first. This is a particularly handy error to employ in programs using I/O. If the device is not open for I/0, then the error can be Trapped. After that the device can be Opened.

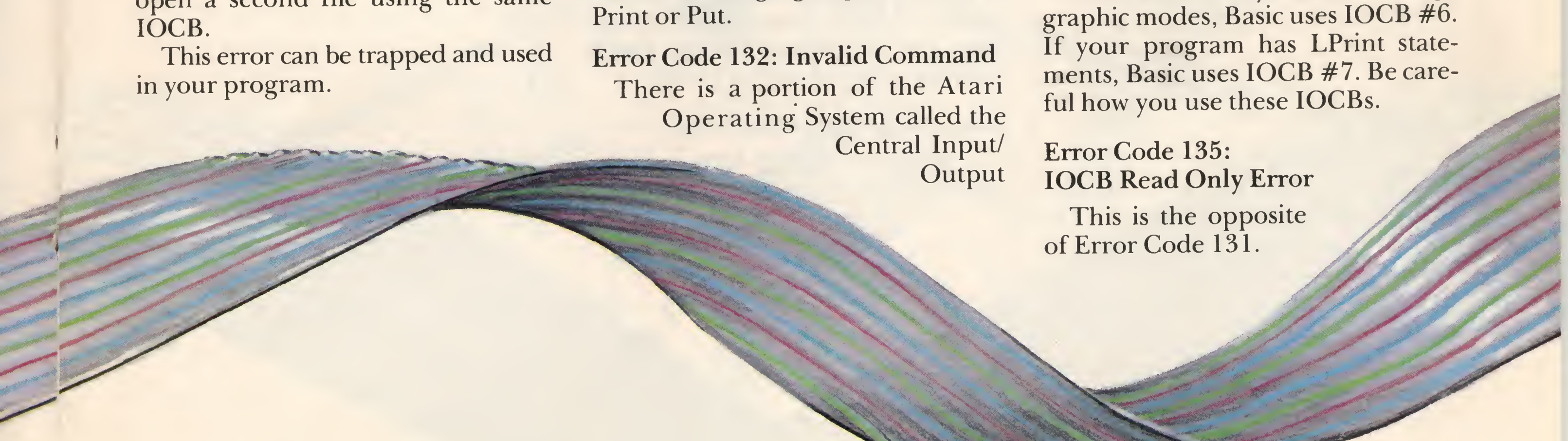
Error Code 134: Bad IOCB Number

Of the eight IOCBs available in Atari Basic, the programmer is allowed to use seven of them (IOCBs 1 to 7). This error code is telling you that you have attempted to use illegal IOCB number. Check your program.

Note: Each time you use or change graphic modes, Basic uses IOCB #6. If your program has LPrint statements, Basic uses IOCB #7. Be careful how you use these IOCBs.

Error Code 135: IOCB Read Only Error

This is the opposite of Error Code 131.



You have attempted to write to a device or file that is open for read only.

Error Code 135 can be used to check to see if a file exists before writing data to it.

```
 10 OPEN #1,4,0,"D:TEST"
 20 TRAP 60:INPUT #1;A$
 30 REM ERROR 135 OCCURS IF
      D:TEST EXISTS
 40 REM ERROR 130 OCCURS IF NO
      SUCH FILE
 50 CLOSE #1:GOTO 100
 60 CLOSE #1:REM IOCB MUST BE
      CLOSED
 70 IF PEEK (195)=135 THEN OPEN
      #1,8,0,"D:TEST":GOTO 20
 80 IF PEEK (195)=130 THEN OPEN
      #1,9,0,"D:TEST":GOTO 20
 90 REM "OPEN #1,9,0" PUTS NEW
      DATA AT ENDOF FILE
100 ...REST OF PROGRAM...
```

Error Code 136: End-Of-File

Error Code 136 is how your computer tells you it has reached the end-of-file. It is one of the more commonly used errors when reading data from files. For example:

```
10 OPEN #1,4,0,"D:TEST":TRAP 70
20 FOR I0 TO O STEP O
40 INPUT #1;A$
50 PRINT A$
60 NEXT I
70 PRINT A$
80 CLOSE #1
90 ...REST OF PROGRAM...
```

Line 10 opens the file and sets the trap. Line 20 sets up an endless For/Next loop that can only be broken when an error happens. Line 40 gets the data (A$) from the file and line 50 prints it to your screen. Line 60 sends the program back to line 20 for the next reiteration. When the end-of-file is reached Error Code 136 is generated, the Trap is sprung, and the program branches to line 70, where the last part of the file is printed. Line 80 closes the IOCB.

> *A code 129 is telling you that you are attempting to open an IOCB that is already open.*

Error Code 137: Truncated Record

This error code means that you are attempting to read a record that is larger than 119 bytes (or characters). It can happen when you are trying to input data that you have stored using the Put command. It also may arise when you attempt to enter a program that you have saved to diskette.

Error Code 138: Device Timeout

Atari calls this the Device Timeout error. There are many factors that can cause it: The device did not respond within the specified time; You have specified the wrong device number or the wrong device; Or the device is not connected. If you are using the program recorder, you may have started the tape in the wrong place.

First, check to see that all your I/O cables are firmly seated, and all devices are turned on. Second, check your program for device errors.

Error Code 139: Device NAK

A peripheral device refuses to acknowledge a command (NAK - not acknowledge). The error is device-specific. Check to see that the offending peripheral device is configured correctly. For instance, in the case of the Atari 825 Printer, check that it is in the On Line position, rather than Local.

It is also possible that you have confused your computer and it is sending erroneous commands. Check your program.

Also check the manual that came with that device for hints.

Error Code 140: Serial Frame Error

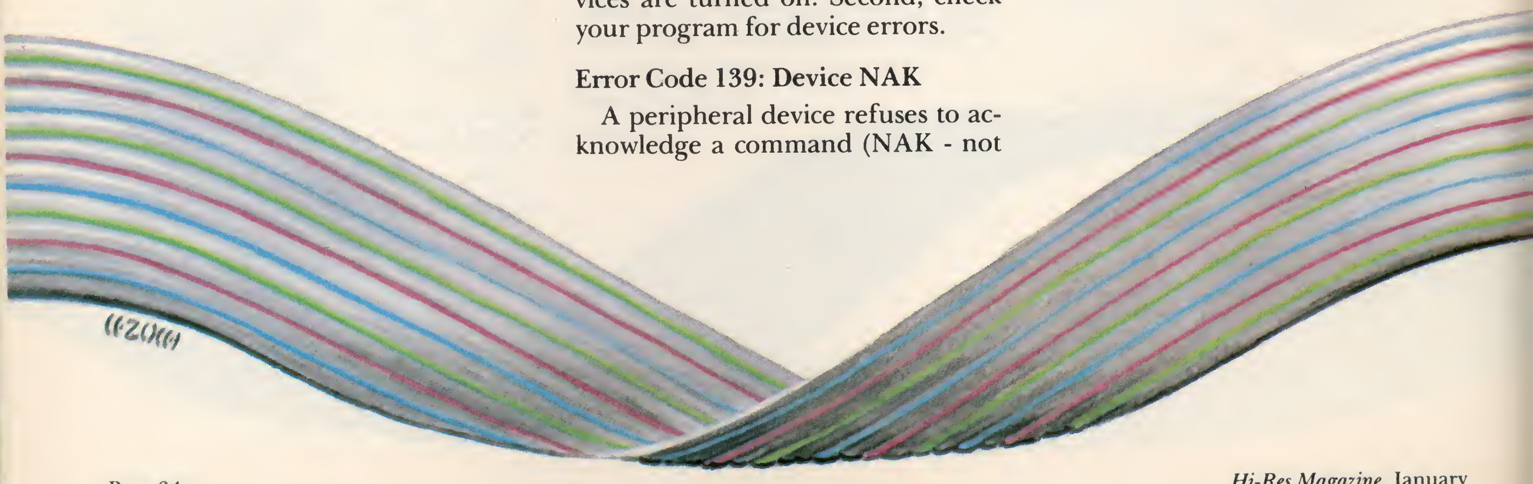
A peripheral device is sending garbage to your computer. Atari says this is a fatal error, and if it happens more than once, have your computer or the peripheral device checked.

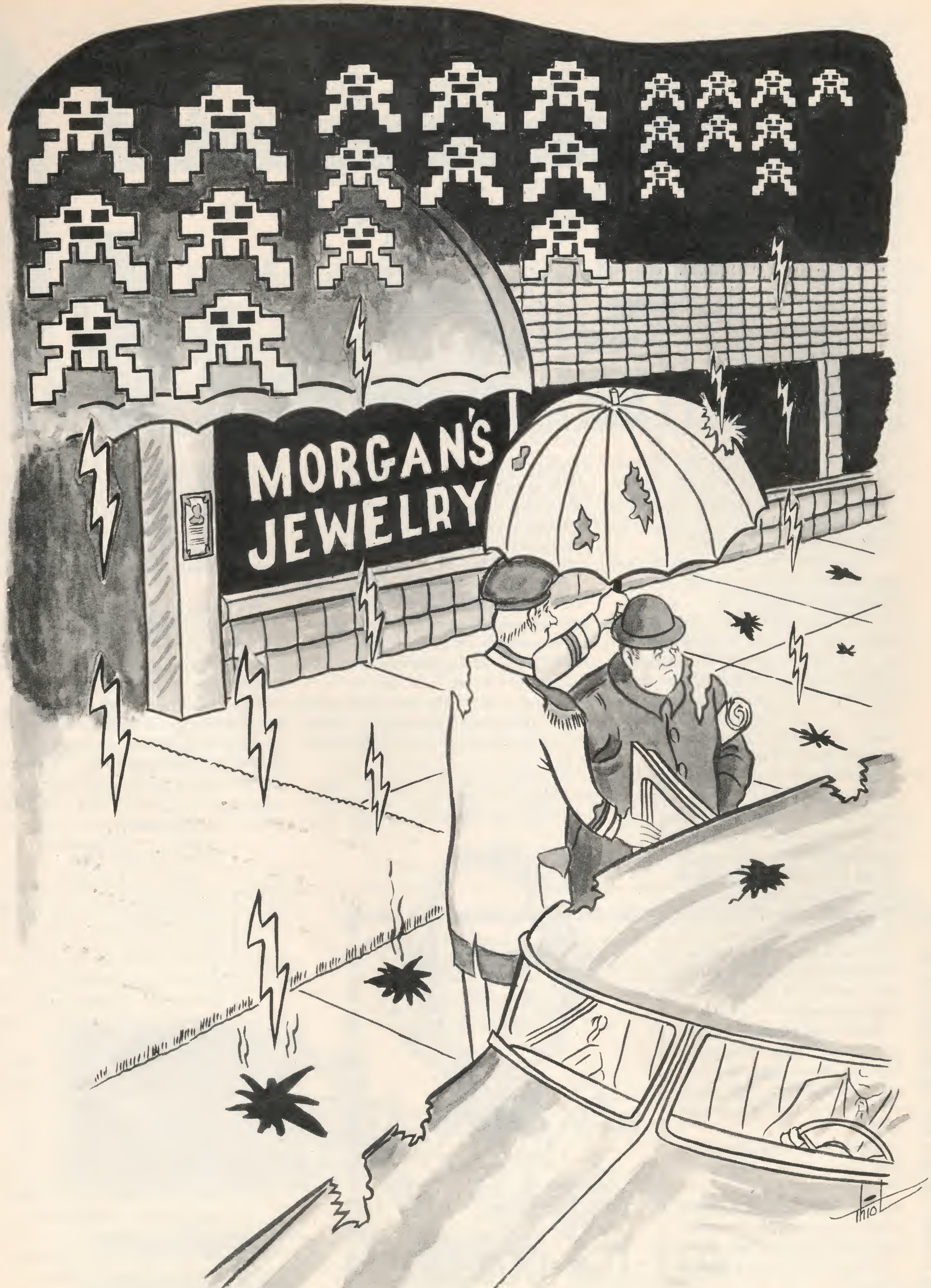
See the *Atari Disk Operating System Reference Manual* for more information.

Error Code 141: Cursor Out of Range

Aha, an error that is not generated by a peripheral device! This one means that your program has tried to place the cursor out of range of the particular graphics mode you are using. Recalculate the location or change your graphics mode. This, too, is covered in the *Atari Basic Reference Manual.*

Next month we'll discuss more I/O error codes, particularly some that are peculiar to the Atari 850 Interface Module.




MORGAN'S
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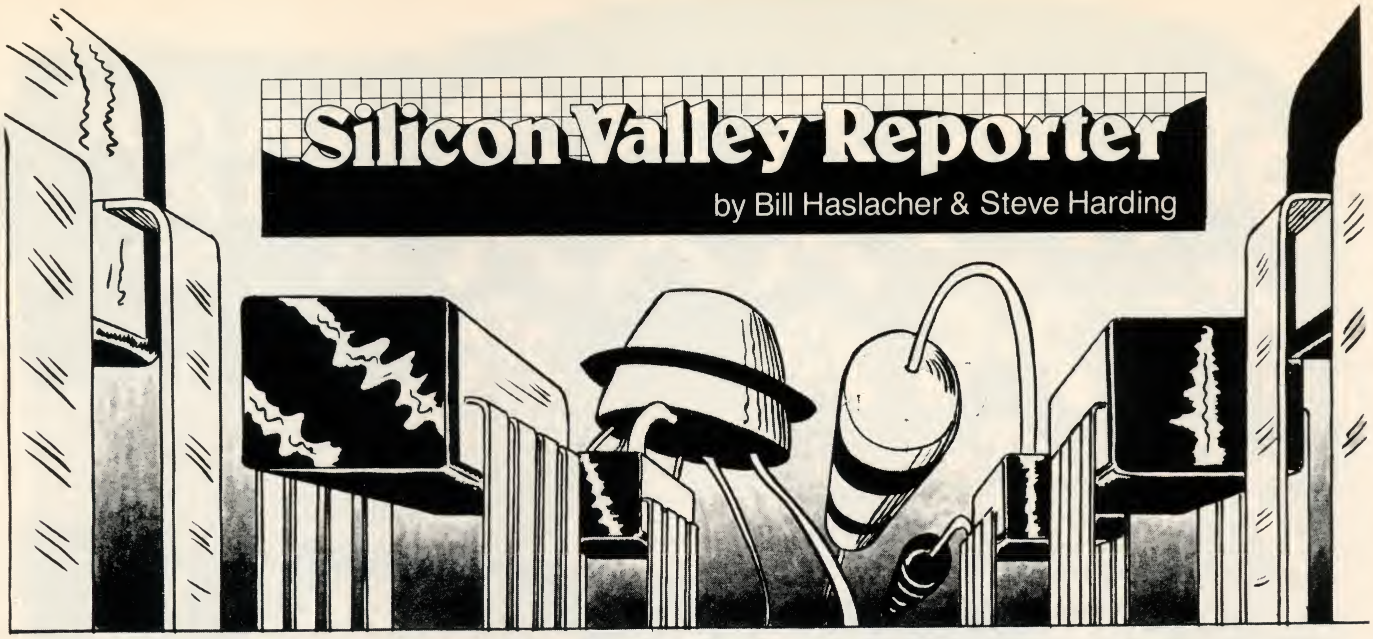
Silicon Valley Reporter

by Bill Haslacher & Steve Harding



Here comes a blue planet. Prepare to land. The view is fantastic. But wait. A strange temple lies right ahead. Crash, zap, bam. The temple becomes your tomb.

New Hollywood science fiction movie? No, it's *Moonsweeper*, a video game from Imagic.

Recently, Bob Smith, the game's designer, took me into the Imagic lab to see this new game. He yelled to others before taking me in to see if anything "top secret" was on the screens. Everything was OK. Stereo music filled the room, and interesting graphics filled the screens.

Moonsweeper is an impressive 3-D space game with some new twists. It starts with a red sun radiating high-resolution solar flares. You can shoot or avoid the flares. Some of the objects coming at you are planets. You get to choose the planet you want. Blue is the easiest. Red is the hardest. I saw a blue planet coming, and I chose it. Wow, the landing on the planet is sure dramatic!

Bob Smith gave me insight into game design. He says the idea for *Moonsweeper* "started with the landing on the planet effect" and built from this effect.

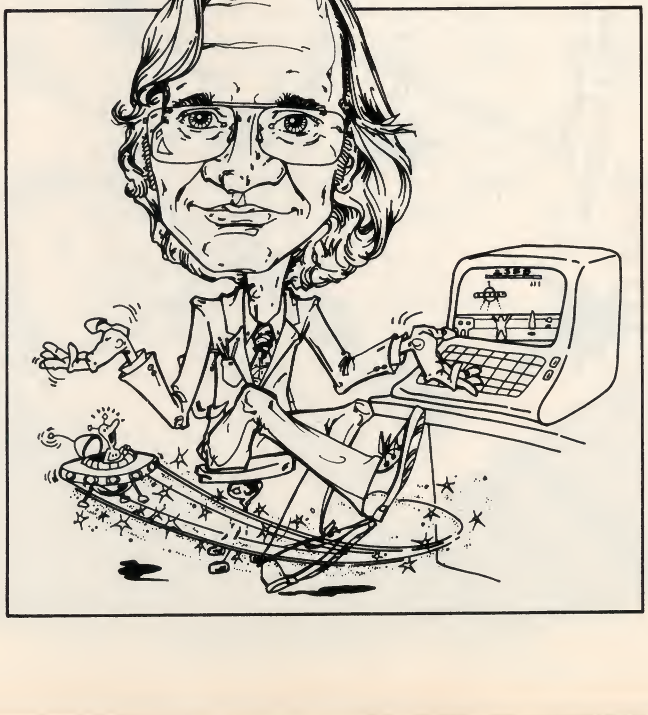
Smith believes some of the best game ideas come from creative sessions in the lab. He feels game programmers make a big mistake if they do not listen to other game designers, because fellow programmers can see mistakes and help make a game better.

Smith is one of a number of former Atari employees now working at Imagic. David Johnson and Brad Stewart are others. At Atari Smith wrote *Atari Pinball* and a number of Home Computer Games.

"Imagic is more like Atari than Atari was," says Smith. "The lab is crowded on weekends and is an enjoyable place to be."

You won't find many Easter Eggs at Imagic. Easter Eggs are hidden messages planted in ROM code. The first Easter Eggs were the programmer's initials planted in ROM. Atari marketing was surprised to learn that if you took a gold dot out of the gold room in *Adventure*, you would see the programmer's initials flash on the screen.

Another example of an Easter Egg is found in *Missile Command*. By not pressing the red button in *Missile Command* bombs destroy your bases and you get to see the programmer's initials. Bob Smith thinks Easter Eggs are fun, but so far he has not put any into his code. This reporter feels part of the reason Smith does not use Easter Eggs is because Imagic programmers get lots of credit and applause for their work.



Game Design Tips

What are Bob Smith's recommendations for getting into game design? "You don't have to be a scientist or mathematician to get into game programming. You should be creative and you should know assembly language and a little math."

Why is math important? "I'm using matrix algebra and that kind of thing in the 3-D space games now," he says. "We have some new development machines for much of the drudgery." Imagic has developed two state-of-the-art graphics machines and one sound machine, which Smith says allow automatic data passing and other programming aids.

Bill Haslacher lives in the heart of Silicon Valley. He is a regular contributor to Hi-Res. *Steve Harding is West Coast Editor of* Hi-Res.

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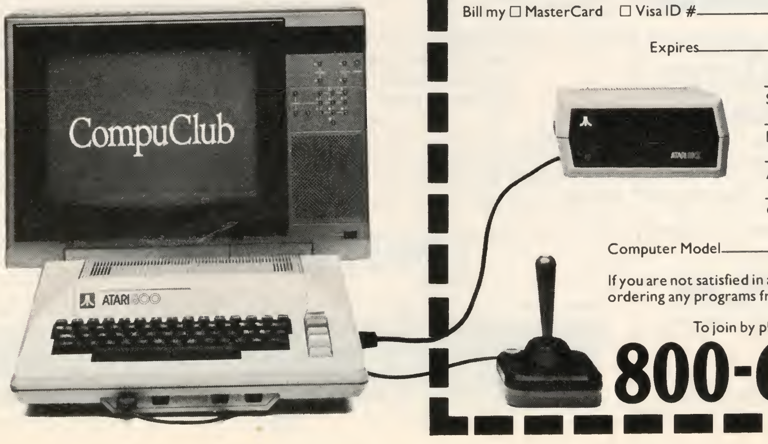

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Some of the best game ideas come from creative sessions in the lab.

Smith feels some of the truly great video games will live forever. Two of his own favorites are *Breakout* and *Space Invaders*. "*Qix* is good," says Bob, "it might even become a classic. *Spider-Man* by Parker Brothers for the VCS is an interesting game, but it also has some glaring flaws."

The future of video games? Smith says, "Video games will achieve even better visual and sound effects." He is particularly impressed with the graphics capability of *Dragon's Lair*, a new coin-operated laser-disk game that is a hit in video game arcades.

Smith believes video games have some value beyond entertainment for young children. "They improve attention span and eye-hand coordination," he says. When Bob Smith was growing up his family loved to play card games, puzzles and all kinds of games. Pure dice games are not among Smith's favorites, however. The reason: "I prefer games with a bit more elan in them." He is sure that the love for games he developed as a child has turned into a passion for developing exciting video games for Imagic.

What Next for Smith?

Bob Smith's big interest in life; outside of gaming, is his family. Steven, age 5, has just learned to yell Bug! when he sees a programming mistake. Adam, age 6, is getting pretty good at playing video games. And his wife, Kathy, cheerfully puts up with video games.

What is Smith's next project? A game for the ATARI Home Computer System is beginning to take shape, he says.

Rumors . . . I love 'em. All kinds of interesting things have been making their way twixt tongue and ear around Silicon Valley lately.

Did you know that not only has Atari decided not to market their *Graduate keyboard for the VCS 2600*, they are going out of the computer business altogether? That's the latest piece of nonsense making the rounds.

Seems that, according to the story, Atari has decided their strength lays in software. Supposedly they're giving up the hardware side of the business. Or. . .if you want to believe another story . . . since Atari has lost so many talented programmers to third-party software houses, they have decided to forget about creating new software for the 2600/5200 and dedicate themselves to the hardware side of the business.

Another interesting tidbit I heard recently . . . *Commodore has made Warner an offer for Atari*. The powers that be are seriously considering it. Who knows?

Let me tell you a little story. Once upon a time, about 1978 BC (Before Computers), Atari's main competitor in the marketplace was *Mattel Electronics*. The marketing and sales executives at Atari were concerned with the impact that they thought Mattel was going to make on the marketplace and were scurrying around conceiving new marketing ploys to circumvent it. This was just after the Video Computer System had been introduced and had not sold as well as these marketing gurus had anticipated. They were nervous.

The people designing the Game Programs were well insulated from

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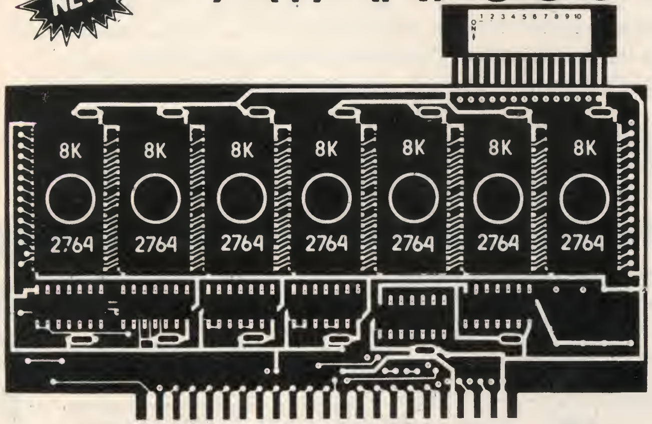

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the marketing folk, as they were housed in a separate building.

One day, when things were a bit slow, a Friday, as I recall (probably shortly before one of the regularly scheduled Friday afternoon beer runs—Oh ... those were the days), one of the staff poked his head out of his office and yelled, "we haven't had a good juicy rumor in months. It's time one got started. Did you know that the (Atari) Consumer Division is going to be sold to Mattel?" Everybody giggled, saying, "Gee, what a neat rumor."

About ten days later, the vice-president in charge of that group called everyone together. In very serious tones he stated, "There is absolutely no truth to the rumor that Mattel is going to buy the Consumer Division and lay everybody off. Your jobs are secure and there is nothing to worry about." Later there was a great deal of snickering.

Moral of the story ... don't believe anything about the doings and goings on at Atari until it happens. And then, take it with a grain of salt.

There has been a great deal of talk recently about *pirate software*, both in the computer industry trade press and the various computer interest magazines. It seems that, in some cases, the consumer feels that once that dollar is in the merchant's till the software is his to do with what he will. Or, understandably, the consumer wants to have a copy of the program, in case something happens to the original

The manufacturer says that all the consumer is buying is the right to use the software, and not the program itself. So why is the price so high? That's to recover the profits lost from the pirated software.

There is a lot to be said for both sides.

Adventure International has devised a scheme that is welcome news. They are packing a coupon with their programs that entitles the buyer to purchase a back-up copy for only $3.99. That just barely covers the cost of the media and mailing.

More software manufacturers should follow their lead. It won't stop software piracy, but the policy does make for happy customers.

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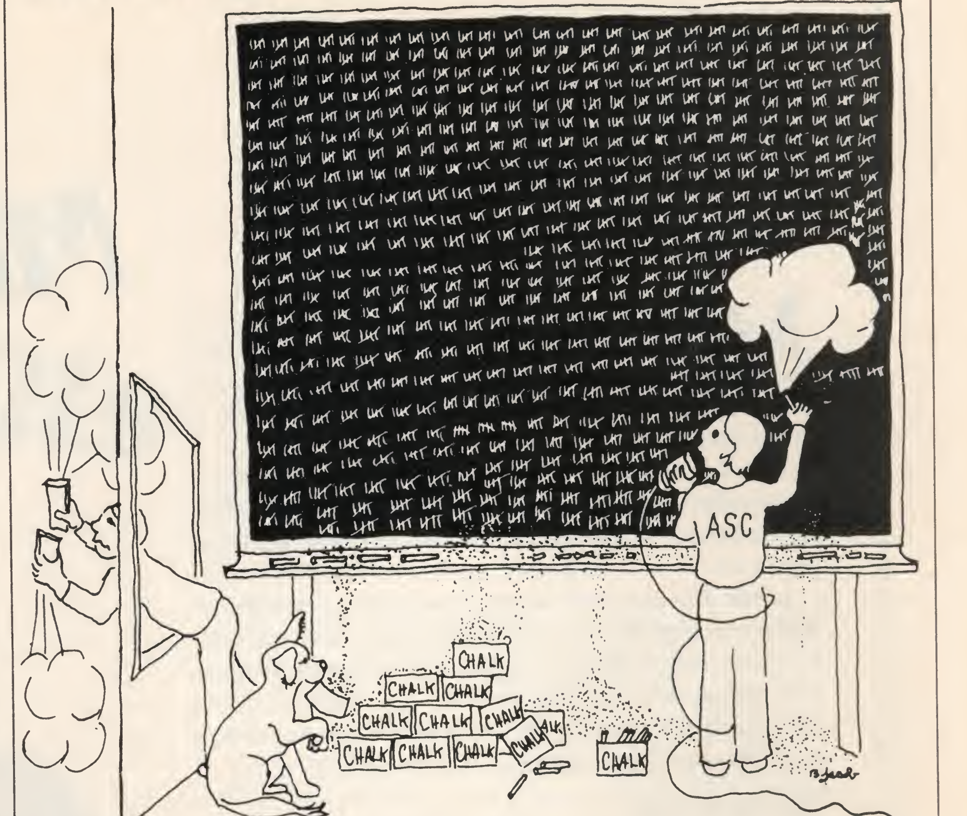

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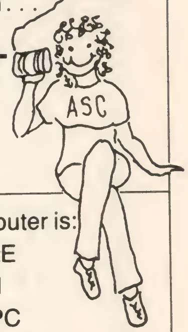

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Music The

My wife and I teach private music lessons in our home. While our students wait for their lessons to begin, they use an Atari computer to test their note reading ability, or their knowledge of music theory.

This month I'll start a series of articles and programs which offer the reader the fundamentals of music theory. Later, we'll talk about creating computer music of your own.

Music Theory Drills is one of a series of programs that I've written that can be used by any student or music teacher. It drills a student on the names of the lines and spaces in both treble and bass clef staffs. You can add advanced features, such as ledger lines and sharps and flats to create a complete drill program.

The Music Staff

A music staff has five lines and four spaces, each represented by a letter or note. The names of the lines in the treble clef staff are E,G,B,D,F (counted from the bottom). The treble clef is commonly called the G-clef and centers on the second line of the staff, the G. The bass clef, a comma-shaped insignia followed by two dots, resides on a staff below the treble. The bass clef line names are G, B, D, F, A.

The spaces between these lines are named as well. The treble clef spaces are F,A,C,E. The bass clef spaces are A,C,E,G. On an imaginary line between these two staffs rests middle C. See Fig. 1.

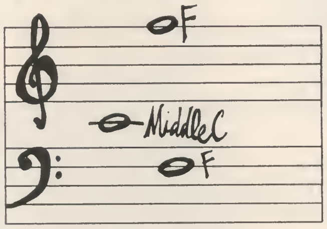

Fig. 1.

The musical alphabet contains the letters A, B, C, D, E, F and G. To determine the name of a note above or below the staff, continue the musical alphabet up or down until you reach your goal.

The Music Theory Drill program starts by displaying two title screens and playing a short arcade-type song. This is followed by the menu, which shows the options of play available. See Fig. 2.

Duane Tutaj writes on educational subjects for Hi-Res. *He lives in Addison, Illinois.*

by Duane Tutaj

eory Drills

The user can choose option 1: treble clef notes only; option 2: bass clef notes only; or option 3: a combination of both treble or bass clef notes.

When you enter your choice, the computer will randomly generate 20 questions. You will be shown a treble or bass clef with a whole note on a line or space in the staff (see Fig. 3). Middle C is also tested, as well as the first space notes above and below the staff.

The computer asks you for the name of the note. Entering your answer, you will either hear a high happy sound or a low raspberry-type sound, indicating right or wrong. The screen also prints: That's correct or Sorry, that is not correct. The correct answer is ---.

A new screen will appear after 20 questions, showing your test results and percentage score. You'll also have a chance to play again.

After my students have mastered the treble and bass clef note names, they advance to a more difficult version of this drill which includes ledger lines, sharps and flats. The students save the results of these drills on disk, so that I can recall them later and find out which students need to review this drill and which students can go on to the next.

I've written drills on key signatures, kinds of notes, note values in various time signatures, pitch recognition, etc. My advanced students use the computer as a means of exploring sound and music composition.

In future issues I'll cover the different rhythms used in music and provide a program that will teach all the different types of notes. After that, I hope to go into more detail about how the opening arcade music in this program was put together.

Program Description

The program starts by initializing some arrays and filling them with a location variable, sound values and note names. The keyboard is opened up for the Get command. Array YY(4) is used in the arcade sound routine at line 25000. Array NNN(24) is used for keeping track of the location variable that plots the notes to the staff. Array PP(23,3) holds three important items:

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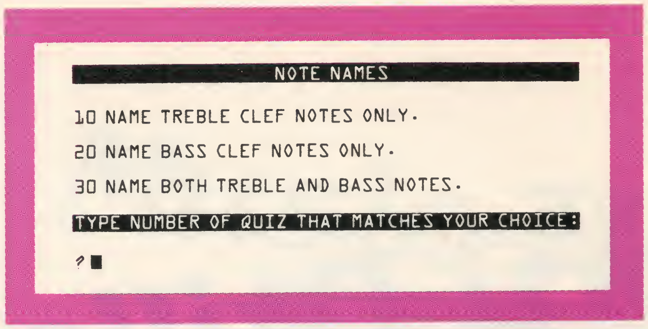


```
NOTE NAMES
10 NAME TREBLE CLEF NOTES ONLY.
20 NAME BASS CLEF NOTES ONLY.
30 NAME BOTH TREBLE AND BASS NOTES.
TYPE NUMBER OF QUIZ THAT MATCHES YOUR CHOICE:
?
```

Fig. 2. A menu from Music Theory Drills.

the low byte, high byte, (used in 16-bit music generation) and name of the note.

I was forced to use the 16-bit sound generation, because of the low notes in the bass clef. The sound statement would not produce the correct pitch. More on 16-bit sound later.

Lines 10 through 80 contain several subroutines that call the title screens, play the arcade music, check for number of questions, plot the staff and get the first note.

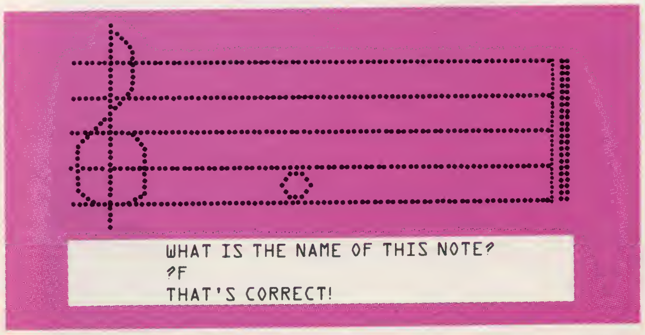
Next, I determine whether to print the treble or bass staff (lines 2000 to 2027) and then plot either the treble clef sign (lines 2029 to 2041) or the bass clef sign (lines 2049 to 2090).

After I have drawn the whole screen, I call the sound routine and turn on the screen again with a Poke 559,34.

The logic for the answer occurs in lines 2210 to 3032. Lines 3050 to 3330 plot the individual notes, by comparing the random number with the corresponding number in the note arrays and then plotting the correct points to the staff.

Next is the 16-bit sound routine. While I won't go into a complete description of all the techniques of 16-bit sound production, I will explain how to use this routine in other programs.

If you have used the Sound statement before in Atari Basic, you know about the chart of pitches in the various reference manuals. By using the numbers in the charts, you are able to produce about three and a half octave range. The 16-bit sound generation increases



```
WHAT IS THE NAME OF THIS NOTE?
?F
THAT'S CORRECT!
```

Fig. 3. A sample screen from Music Theory Drills.

the range to more than seven octaves with the tuning more exact.

To use 16-bit sound generation, execute a Sound 0,0,0,0 statement to turn on the Pokey chip. Poke 53768,120 turns on the audio mode control register (Audctl). The number 120 combines channels 1 and 2 as one voice and 3 and 4 as the other voice with a clock frequency of 1.79 MHz.

Poke 53763,168 to set the distortion and volume levels. Frequency is set in the Pokes to 53760 (lo byte) and 53762 (hi byte). If you wish to use this technique in your programs compare the values in array PP(23,3) to determine the pitch and name of the note.

YY	(4) Arcade music array.
NNN(23)	Plot note variable.
PP(23,3)	16-bit note sound variables and names of notes.
J,JJ,Q,Z,I	Counters.
P,Y	Temporary variables.
MENU	Option of game drills.
H	Random staff variable.
A	Input variable.
NN	Name of note.
R	Plot note variable.
RR	Correct answer variable.
WW	Wrong answer variable.
C	Question counter
K	Total question variable.
PP	Percentage score variable.

Table 1: A list of variables I used in Music Theory Drills.

Be aware that any use of the sound statement, after you have set up 16-bit generation, will cancel the 16-bit sound.

Lines 4000 to 4100 are the right answer routine message followed by lines 5000 to 5110 which contain the wrong answer routine.

Lines 7000 to 7010 determine which staff should be drawn and then jump to that routine. The staff lines are drawn with the routine at lines 8000 to 8080.

Lines 13000 to 13007 contain the routine that draws the note on the staff. This is based on the variable which was placed in the array NNN(23).

Lines 18100 to 18200 contain the sounds that go with a correct or incorrect answer.

Lines 20000 to 20175 print the title screens and call the arcade music subroutine. The Menu is also printed to the screen. After a selection is made, the main variables are given values, and the program returns to the main loop.

Lines 22000 to 22160 check for whether 20 questions have been completed or not, and when this level has been reached, the score for the quiz is printed to the screen, and an option is given for doing the quiz again.

Lines 25000 to 26155 are the subroutine that plays the arcade music at the start of the program. Each note is placed in an array, and then all four voices are played. The technique is not hard, but a good knowledge of music notation is required, to have the rhythms turn out correctly. More on this technique in a future article.

If you wish to see the notes and staff drawn on the screen, without the screen going black, eliminate the Poke 559,0 in line 8000 and the poke 559,34 in line 2201.

```
1 REM MUSIC THEORY DRILLS PART ONE
2 REM BY DUANE TUTAJ
3 REM COPYRIGHT 1983
4 DIM YY(4):OPEN #1,4,0,"K:":DIM NNN(2
4):RESTORE 5:FOR J=1 TO 23:READ N:NNN(
J)=N:NEXT J:N=0
5 DATA 47,42,37,32,27,22,17,12,7,2,52,
57,47,42,37,32,27,22,17,12,7,2,52
6 DIM PP(23,3):RESTORE 7:FOR J=1 TO 23
:FOR JJ=1 TO 3:READ P:PP(J,JJ)=P:NEXT
JJ:NEXT J
7 DATA 148,10,69,251,9,70,228,8,71,235
,7,65,13,7,66,167,6,67,237,5,68,70,5,6
9,250,4,70,110,4,71,224,11,68,85,13,67
8 DATA 165,35,71,192,31,65,73,28,66,17
8,26,67,200,23,68,47,21,69,254,19,70,2
07,17,71,221,15,65,33,14,66,3,40,70
10 GOSUB 20000:REM PRINT TITLE AND MUS
IC
20 GOSUB 22000:REM CHECK IF 20 QUESTIO
NS
30 GOSUB 8000:REM PLOT STAFF
80 GOTO 3000:REM GET NOTE
2000 IF MENU=3 THEN GOSUB 7000
2026 IF H=1 THEN GOTO 2030
2027 IF H=2 THEN GOTO 2050
2029 REM PLOT TREBLE STAFF
2030 PLOT 15,0:DRAWTO 15,60
2031 PLOT 15,0:DRAWTO 21,6:DRAWTO 21,1
2
2032 PLOT 21,10:DRAWTO 21,18:DRAWTO 15
,24
2033 PLOT 14,25:DRAWTO 5,34
2034 PLOT 5,34:DRAWTO 5,45
2035 PLOT 5,45:DRAWTO 10,50
2036 PLOT 20,50:DRAWTO 25,45
2037 PLOT 25,45:DRAWTO 25,34
2038 PLOT 25,34:DRAWTO 23,32
2039 PLOT 23,32:DRAWTO 21,30
2040 PLOT 13,30:DRAWTO 11,32:DRAWTO 11
,35
2041 RETURN
2049 REM PLOT BASS STAFF
2050 PLOT 10,25:DRAWTO 7,22:DRAWTO 7,1
9:DRAWTO 10,14:DRAWTO 17,12:DRAWTO 24,
14:DRAWTO 26,17:DRAWTO 27,19
2052 PLOT 27,19:DRAWTO 28,22
2060 PLOT 28,22:DRAWTO 27,26:DRAWTO 14
,47
2070 PLOT 33,14:DRAWTO 35,14:PLOT 33,1
5:DRAWTO 35,15:PLOT 33,16:DRAWTO 35,16
```

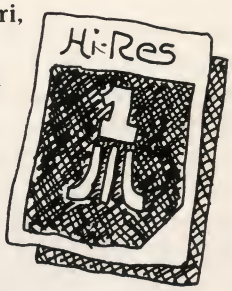
Listing Continues

```
2080 PLOT 33,24:DRAWTO 35,24:PLOT 33,2
5:DRAWTO 35,25:PLOT 33,26:DRAWTO 35,26
2090 RETURN
2200 REM GOSUB SOUND
2201 GOSUB 3800:POKE 559,34
2210 POKE 764,255:? "?";:GET #1,A:? CH
R$(A):REM GET ANSWER
2215 LET NN=PP(N,3)
2220 IF A=NN THEN GOTO 4000
2230 IF A<>NN THEN GOTO 5000
3000 PRINT "WHAT IS THE NAME OF THIS N
OTE?"
3030 IF MENU=1 THEN N=INT(RND(0)*12)+1
:GOSUB 2030:GOTO 3100
3031 IF MENU=2 THEN N=INT(RND(0)*11)+1
3:GOSUB 2050:GOTO 3300
3032 IF MENU=3 THEN N=INT(RND(0)*23)+1
:GOSUB 2000:GOTO 3100
3050 REM PLOT NOTE
3100 R=NNN(N)
3102 IF R=57 THEN PLOT 60,60:DRAWTO 80
,60
3104 GOTO 13000
3130 IF MENU=1 THEN GOTO 2200
3132 IF MENU=3 THEN GOTO 3300
3300 R=NNN(N)
3304 GOTO 13000
3330 GOTO 2200
3800 SOUND 0,0,0,0
3802 POKE 53768,120:POKE 53763,168
3804 POKE 53760,PP(N,1):POKE 53762,PP(
N,2):RETURN
4000 REM CORRECT ANSWER
4010 POKE 752,1:? "THAT'S CORRECT!"
4020 GOSUB 18200:FOR JJ=1 TO 300:NEXT
JJ
4100 RR=RR+1:C=C+1:GOTO 20
5000 REM WRONG ANSWER LOOP
5100 GOSUB 18100:PRINT "SORRY, THAT IS
 NOT CORRECT,"
5105 ? "THE CORRECT ANSWER IS ";CHR$(N
N);".":? "HIT ANY KEY TO CONTINUE";:PO
KE 752,1:POKE 764,255:GET #1,A
5110 WW=WW+1:C=C+1:GOTO 20
7000 IF MENU=3 THEN GOTO 7009
7009 IF N<=12 THEN H=1:RETURN
7010 IF N>=13 THEN H=2:RETURN
8000 GRAPHICS 6:POKE 559,0:POKE 710,11
2
8020 COLOR 3
8022 SETCOLOR 3,10,10
8030 PLOT 5,10:DRAWTO 150,10
8040 PLOT 5,20:DRAWTO 150,20
8050 PLOT 5,30:DRAWTO 150,30
8060 PLOT 5,40:DRAWTO 150,40
8070 PLOT 5,50:DRAWTO 150,50
8075 PLOT 147,10:DRAWTO 147,50:PLOT 15
0,10:DRAWTO 150,50:PLOT 149,10:DRAWTO
149,50
8080 RETURN
13000 PLOT 68,R:DRAWTO 72,R
13001 PLOT 68,R:DRAWTO 72,R
13002 PLOT 67,R+1:PLOT 73,R+1
13003 PLOT 66,R+2:DRAWTO 66,R+4
13004 PLOT 67,R+5:PLOT 73,R+5
```

Listing Continues

Coming Next in *Hi-Res:*

Games and educational programs *you* can type, plus *Hi-Res* reviews!



The Saga of Jack Truehart: Leo LaPorte starts his investigation of the Atari, turning it inside-out.

Episode one begins the perils of POKEY. Murder and intrigue tale McGinty through the mother board, until his fried remains are discovered on an idle trace.

Electronic Arts: Next time in *Hi-Res* we'll meet some of the people behind Electronic Arts and fill you in on their latest "creations" for the Atari. We'll have five E.A. programs reviewed.

Our cover feature takes you to the Caribbean for a glimpse of Club Med's Atari vacation. If Winter's got you blue in Buffalo, then this white-dunned spread is bound to please.

Duane Tutaj continues his music theory drill and Mark Murley will be back with a review of Infocom's *The Witness.*

```
13005 PLOT 68,R+6:DRAWTO 72,R+6
13006 PLOT 74,R+4:DRAWTO 74,R+2
13007 GOTO 2200
18100 REM WRONG ANSWER SOUND
18101 POKE 53760,0:POKE 53762,0:FOR JJ
=1 TO 15:SOUND 0,60,4,10:NEXT JJ:SOUND
 0,0,0,0:RETURN
18200 REM CORRECT SOUND
18201 POKE 53760,0:POKE 53762,0
18202 FOR Q=1 TO 5:SOUND 0,20,10,10:NE
XT Q:FOR Q=1 TO 15:SOUND 0,35,10,10:NE
XT Q:SOUND 0,0,0,0:RETURN
20000 GRAPHICS 17:POKE 710,210
20005 POSITION 0,3:? #6;"music theory
drills "
20010 POSITION 6,8:? #6;"PART 1"
20020 POSITION 4,13:? #6;"note names"
20025 GOSUB 25000
20030 GRAPHICS 17:POSITION 9,3:? #6;"b
y"
20040 POSITION 4,10:? #6;"DUANE  TUTAJ
"
20050 POSITION 2,21:? #6;"COPYRIGHT  1
983"
20060 GOSUB 25000
20070 FOR Z=1 TO 100:NEXT Z
20100 GRAPHICS 0:POKE 710,112
20105 ? :? :? "                NOTE  NAM
ES              "
20110 ? :? :? "1) NAME TREBLE CLEF NOT
ES ONLY."
20115 ? :? "2) NAME BASS CLEF NOTES ON
LY."
20120 ? :? "3) NAME BOTH TREBLE AND BA
SS NOTES."
20150 ? :? :? "TYPE NUMBER OF QUIZ THA
T MATCHES YOUR CHOICE."
20160 ? :? :POKE 764,255:? "?";:GET #1
,A
20165 IF A=49 THEN MENU=1:GOTO 20
20166 IF A=50 THEN MENU=2:GOTO 20
20168 IF A=51 THEN MENU=3:GOTO 20
20171 ? " YOU TYPED A WRONG NUMBER.":G
OTO 20172
20172 FOR I=1 TO 200:NEXT I
20175 GOTO 20100
22000 IF C<20 THEN RETURN
22050 REM PRINT TEST RESULTS
22060 GRAPHICS 17:POKE 710,122
22070 ? #6;"HERE'S YOUR RESULTS!"
22080 POSITION 0,4:? #6;"YOU HAD ";RR;
" CORRECT."
22082 KK=RR+WW:LET PP=INT((RR/KK)*100)
22083 POSITION 0,8:? #6;"AND ";WW;" WR
ONG.":POSITION 0,12:? #6;"FOR A SCORE
OF ";PP;"%."
22085 FOR I=1 TO 300:NEXT I
22100 POSITION 0,15:? #6;"would you li
ke":POSITION 0,17:? #6;"to play again?
":POKE 764,255:GET #1,A
22101 IF A=89 THEN GOTO 22150
22102 CLOSE #1:END
22150 C=0:WW=0:RR=0:KK=0
22160 GOTO 20100
25000 REM PLAY ARCADE MUSIC
25010 RESTORE 26000
25300 FOR Z=0 TO 3:READ Y:IF Y=9999 TH
EN GOTO 25320
25305 YY(Z)=Y:NEXT Z
25310 SOUND 0,YY(0),10,10:SOUND 1,YY(1
),10,4:SOUND 2,YY(2),10,4:SOUND 3,YY(3
),10,10
25315 SETCOLOR 2,INT(16*RND(1)),6
25317 GOTO 25300
25320 FOR Z=0 TO 3:SOUND Z,0,0,0:NEXT
Z:RETURN
26000 DATA 53,0,0,162,40,108,128,162,4
0,0,0,217,47,108,128,217
26010 DATA 53,0,0,162,64,108,128,162,8
1,0,0,217,72,108,128,217
26020 DATA 64,0,0,162,53,108,128,162,6
4,0,0,217,72,108,128,217
26030 DATA 64,108,128,162,64,0,0,217,0
,0,0,193,0,0,0,173
26040 DATA 53,0,0,162,40,108,128,162,4
0,0,0,217,47,108,128,217
26050 DATA 53,0,0,162,64,108,128,162,8
1,0,0,217,72,108,128,217
26060 DATA 64,0,0,173,72,121,144,173,8
1,0,0,217,64,121,144,217
26070 DATA 72,121,144,173,72,0,0,217,0
,0,0,193,0,0,0,173
26080 DATA 53,0,0,162,40,108,128,162,4
0,0,0,217,47,108,128,217
26090 DATA 53,0,0,162,64,108,128,162,8
1,0,0,217,72,108,128,217
26100 DATA 64,0,0,162,53,108,128,162,6
4,0,0,217,72,108,128,217
26110 DATA 64,108,128,162,64,0,0,217,0
,0,0,193,0,0,0,173
26120 DATA 40,0,0,162,53,108,128,162,5
3,0,0,217,47,108,128,217
26130 DATA 53,0,0,162,64,108,128,162,8
1,0,0,217,72,108,128,217
26140 DATA 64,0,0,162,81,108,128,162,7
2,0,0,217,85,121,144,217
26150 DATA 81,108,128,162,81,108,128,1
62,81,108,128,162,0,0,0,0
26155 DATA 9999
```

Program Listing 1. Music Theory Drills.

Advertiser's Index

Atari	Cover 2, 1,3
Adventure International	Cover 3, 69
American Software	39
Big Five Software	12
CompuClub	37
Compu-Tech	42
Computer Creations	79
Computer Palace	52,53
Computer Software Services	71
Datamost	24,25
Datasoft	23
First Star Software	5
Forest Hills	17
Optimized Systems Software	58,59
PC & J Graphics	74
PMI	14
Show & Tell Video	15
Sierra On-Line	Cover 4
Starbound Software	74
STC	74
Tel-Link	38
The Computer Book Club	63
Tronix	7,31

Meet David Crane: Video Games Guru

by Colin Covert

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This is a story about a famous person whose name you've probably never heard. He is a modern artist. His works adorn millions of homes nationwide. They command the families' attention for hours on end every week. His income is astronomical. Yet only now are he and others like him emerging as significant figures in the public consciousness.

Our subject is David Crane. He designs the most popular video games in America.

At 29, Crane is an unlikely superstar, a gangly six-foot-five coat rack of a guy with an all-American exterior and a *Scientific American* soul. Blond hair falls in straight bangs across his forehead, and he sports a sandy beard of recent vintage. The instruction brochure of his best-selling home video game *Pitfall* put his face before so many young players that people had begun requesting his signature at the supermarket. "People asked me for my autograph. I thanked them for asking," he says, bemused. That's when he grew a beard to change his appearance. Having become famous after a fashion, Crane, who is shy at parties, is striving to go incognito. Uneasy lies the head that wears the crown.

His complexion is pale by California standards; designing video games is an indoor occupation. The pitch of his voice is high, almost adolescent. His characteristic expression is a wry smile, a little grin that just puckers the corners of his cheeks. He looks uncoordinated but is by all accounts a cut-throat tennis player. And, in the estimation of many people who know him, he's a genius.

Genius means something different in Silicon Valley than it does to the south in Hollywood, where a "genius" is anyone whose latest film is making money. To computer professionals in Mountain View, Sunnyvale, or San Jose, "genius" is an accolade that implies vast technical expertise. Crane, a virtual Berlitz academy of computer languages, is also a genius in the Hollywood sense. His games are the nearest things to sure hits in the industry.

Video games—once a sizable fad, then a swelling craze—are becoming the dominant entertainment industry of the Eighties, a white-hot vortex of art, technology, show biz, and, above all, money. Atari paid a staggering $22 million to license Steven Spielberg's character E.T. for a video game. Best-seller charts rank the Top 15 game cartridges in *Billboard* magazine, giving them equal status with the nation's favorite LP's. And justly so. Between the arcade Cyclopes and the home versions of video games, the industry may gross as much as $6 billion this year, according to Ronald Stringari, a vice president of *Atari Corporation*. At that plateau, video games will be a bigger business than the motion picture and record industries combined.

Despite the eary December 1982 panic that knocked video game stocks down by as much as 33 percent per share overnight (as happened to Warner Communi-

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Colin Covert writes for the Detroit Free Press *and is a contributing editor of Ambassador Magazine.*

The game may take only a few minutes to play, but they can take six to eight months to create.

cations, parent company of Atari), few onlookers feel the potential of the video game business has been realized. Observers estimate that on Christmas morning 1982, there were game consoles in 14 million of the 80 million U.S. households with televisions. The Yankee Group, a Boston high-tech consulting firm, projects that by 1990 60 million U.S. households will be equipped to play video games.

Ironically, since its birth a decade ago this has been an entertainment industry without stars. Though game cartridges alone accounted for $1.5 billion in sales last year, most of the designers who write, direct, and produce these megahits labor in obscurity. Imagine the film industry if Hitchcock or Coppola were unknown, the music world if Streisand or Bernstein were anonymous, and you've got a reasonable picture of what the video game industry has been until now.

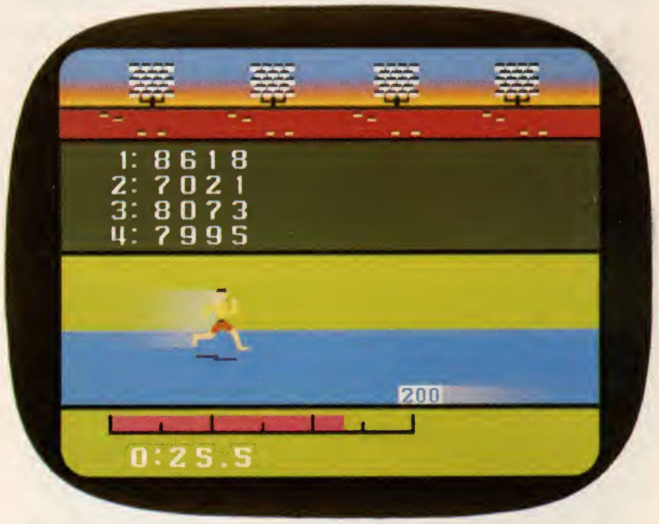
Designing a good video game is more than a token victory. The games may take only a few minutes to play, but they can take six to eight months to create, months of insomniac hours, tedium, sudden fortune, and sudden disaster. Physically, video game cartridges are nothing more than tiny flakes of melted sand jammed into cheap plastic cases. What makes them come to life, creating the little dramas that have become our new national pastime, are the instructions etched onto those silicon chips—the programming.

In the whole world just a handful of people know how to conjure a game on the screen of a home television set. New York's Institute of Electrical and Electronics Engineers estimates that there are only 100 video game designers in the nation. The hurdles would-be designers must pass are at least equal to those confronting other computer professionals. Designers must combine an adolescent enthusiasm for games with a disciplined understanding of microcode and an intricate knowledge of the game computer's architecture.

Microcode, a complex computer programming system, moves jittery bits of whizzing electricity through the chip on a painfully precise one-to-one basis. In one microcode game program, the shape of a castle is described as HS26263E3A2F3E. Such are the nouns of the language that directs the machine and defines the play. Every object's size, form, color, movement, trajectory, and speed must be detailed. Orchestrating a cascade of electronic impulses to the correct destinations requires hundreds of pages of formidably rigid instructions. The work is as unforgiving as brain surgery. There is no margin for error.

Nevertheless, to a certain kind of individual, the work is irresistible. The fascination of trying to get complex equipment to function *just so* can be enormously gripping. Steve Cartwright, who, like David Crane, is a "name" designer, describes the work as an obsession. "I'd do this even if I weren't getting paid to." There is a joy in beating the system that gives rise to an often-repeated aphorism of David Crane's. Crane's Law says that man will always use his most advanced technology to amuse himself.

The few men who can harness that technology (games design is a virtually all-male fraternity) are the creative basis of the entire industry. But one of the games companies play is awarding designers scant credit for the enormous profits squeezed out of their video games. The largest manufacturers—Atari, Mattel, and Coleco—routinely refuse to assign credit for their games. Company officials publicly maintain that all their games are produced by teamwork, so crediting an individual would be inaccurate and unfair to the rest of the team. The firms sometimes tie themselves in embarrassing knots complying with these policies. A recent issue of *Intellivision News*, the slick newsletter from Mattel for Intellivision owners, includes a lengthy interview with "the man who designed and programmed" the game Utopia, Nowhere in the article is the designer's identity disclosed.



Decathlon *is Cranes newest video game on the market.*

Laboring in anonymity is quite a sore point for most designers, according to Alan Miller, who joined Atari after a stint at NASA. "When I worked at NASA and people asked me what I did, I really couldn't tell them. The nature of that kind of engineering is such that you work on small parts of a number of larger projects. But games design is different. You are creating something that is an expression of yourself. A game designer has as much right to be credited for his work as a composer." Some wily designers found ways to take public credit without their bosses' knowledge, Miller says. Two of his former Atari colleagues programmed their games to reveal their identities onscreen after a chance series of moves.

Today, through a combination of hard-won legitimate recognition and sheer industry hype, designers are entering the limelight. Even monolithic Atari, which has long suppressed designers' identities fearing personnel raids and industrial espionage, has begun to name names. The imaginative people who devise video games for a living are becoming public figures, with fan clubs and even pestering groupies. Throughout the nation, teenagers are filling mail sacks with requests for mementos from their idols: an autographed printout of Rob Fullop's data-entry routines perhaps, or a note on code-crunching tips from Carol Shaw. Many kids with personal computers are beginning to program their own games. If through repetitious play some teenagers are turned on to new professions in computer science, then the mania is worth it.

The leader in crediting designers for their creations is Activision, whose president, former recording industry executive Jim Levy, promotes his people like rock stars. The flourishing software firm was founded in 1979 by Levy, Crane, Alan Miller, Bob Whitehead, and Larry Kaplan, all disaffected Atari designers who wanted more money and recognition.

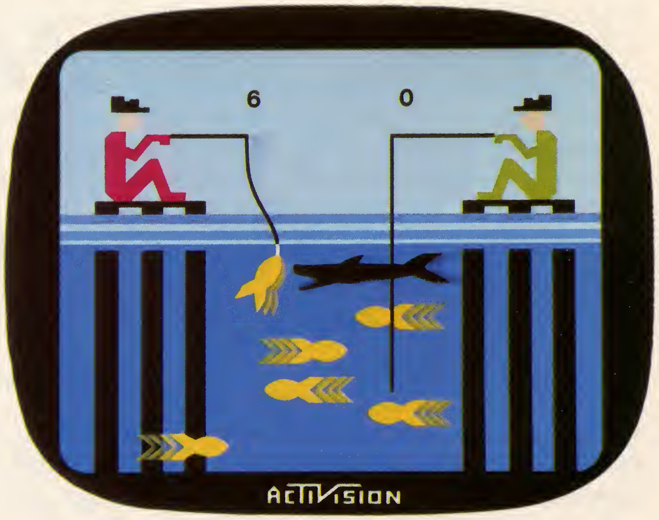
From the first, every Activision game was packed with an instruction manual carrying a photograph of its creator and a signed letter with the designer's playing tips. Activision ads also emphasized the designers' names. Levy made every effort to boost his staff in hopes they'd build a loyal following. Video gamers, the theory went, would rush out to buy the designers' new games, just as readers eagerly purchase a favorite author's latest novel.

It worked. Of 25 cartridges the company has released to date, a dozen have "gone gold," with more than half a million sales. Three have "gone platinum," breaking the million mark. Today Activision's designers receive 12,000 fan letters a week, according to vice president and editorial director Tom Lopez. Skeptics are led to Activision's highly congested mailroom to see for themselves the mountains of correspondence generated by Activision's stars.

The mailman's nemesis, the man behind *Pitfall*, the video game megahit of 1982, is a homespun computer virtuoso from Nappanee, Indiana: David Crane.

Crane doesn't act the part of a blue-chip success. As a founder of Activision, which has zoomed from nothing to approximately $125 million in sales in four years, he has doubtless made his first million, maybe multiples. Yet he remains remarkably unaffected by prosperity.

Crane dresses for work as if he were on the way to a softball game. Blue jeans are the designer's unofficial badge of office—the people in Activision's research lab dress more casually than the people in the mailroom—but Crane takes perverse pride in declaring that he's worn a suit "precisely three times in my adult life." He appears to be making a kind of disheveled statement about rejecting the trappings of maturity. His shoes—cheap brogues the size of gunboats—are worn to mere nubs. "These are Red Wing shoes, and, obviously," he says, raising one outlandish foot to display a dwindling heel, "I wear them until they are well used." Not because he can't find shoes in his size, he insists, but only because they're comfortable. "It's not hard to find shoes when you know where to look. I've visited my home town in Indiana twice in the last ten years, and I never fail to stop by the shoe store. The owner always has a pair for me. He keeps one pair of 15 double-A Red Wings in stock, just in case I drop by."



Fishing Derby, *a 2600 game from Activision.*

Nor does Crane work in a lavishly appointed lab. The designers share a little row of cubicles without doors, each designed to contain one person. Their walls don't reach the ceiling, but stand about five and a half feet high. You can look over them. Like study carrels, they create no privacy. Each has a desk with a standard-issue color TV, a computer console, and a few unclassifiable electronic gewgaws on it. A few cubicles have Activision ads or cartoons pinned to their cloth-covered steel walls. None have green houseplants or a vase of cut flowers to soften the functional feel of the place. Overall, the designers' environment looks like a rat maze designed by a tasteful behavioral psychologist.

If you are what you eat, Crane is pure junk. "I have a real rich palate," he says with his trademark smirk of amusement. "I eat virtually every meal in a sandwich shop: hamburgers, stuff like that. I am a chocolate milkshake connoisseur." His diet, a mulch of tuna sandwiches, candy, and cola that hardly seems capable of sustaining intelligent life, is a source of horrified amusement to most of his friends. Although he's a teetotaler, he hasn't placed many other curbs on his ap-

Today, through a combination of hard-won legitimate recognition and sheer industry hype, designers are entering the limelight.

petite. Crane lopes through the halls of the research lab carrying a liter beer mug filled to the lip with soda, which fuels his inspiration the way absinthe fueled Oscar Wilde's. When he traveled to New York City to accept the video industry's award as best game designer of 1983, Crane indulged himself by ordering $20 worth of white chocolate pretzels. The delivery boy misunderstood and brought 20 *pounds* instead. Crane lit up with joy.

In all of this, he is not much different from his coworkers. Candy cravings have evolved into a standing joke around the Activision office, where everyone has a particular favorite. Alan Miller favors M&Ms in every color but brown. A typical idea meeting leaves the conference room table litered with depleted tins of Excedrin, brimming ashtrays, and half-eaten chocolate chip cookies. The entire organization seems to tremble on the brink of diabetic shock. "If there's one trait designers have in common," Crane says, "it's our taste for chocolate."

Crane favors simple pleasures after hours as well. He lives in an apartment complex he calls "a Silicon Valley microcosm," where he can quickly find a tennis partner, a bridge party, or a computer professional when the mood for a technical bull session strikes. His apartment, though less austere than his lab, is decidedly modern and functional. Everything centers around the big-screen TV that dominates the living room. A sectional sofa curves around it to accommodate friends who drop in to watch Crane's collection of laser-disc movies. An octagonal game table in the dining room is eternally set up for bridge.

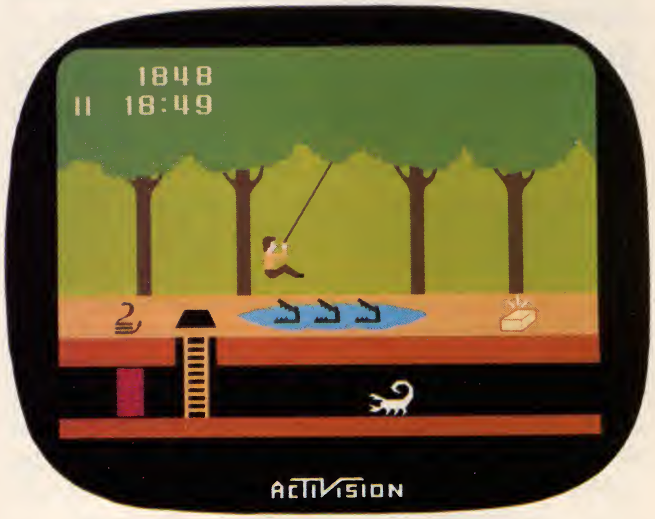
Until his latest housecleaning, the spare bedroom was littered with paperback science fiction novels, newspapers, and magazines. This idea-mulch for future games blanketed the room "to the point where you couldn't tell what was going on," Crane says. "It was books everywhere. I read reams of science fiction. 'Cause, hey, sci-fi's my life, to quote Mork." Crane's mother feeds his habit, spending weekends at garage sales with a computerized list of every science fiction book in her son's collection, buying second-hand books for a dime apiece. Crane returns with boxes of them every time he visits his parents in San Diego.

Crane had little patience for books until quite recently. "I never read when I was a kid. I don't know, maybe it took too long. Now I like mostly light science fiction. I've read some social science fiction, but...," he pauses, groping for a suitable distasteful description, "it's just like the real world," he finishes, grinning.

Reading occasionally gives Crane notions that become games. So do movies; Crane recently saw the animated Disney feature *The Sword and the Stone* and was impressed with the climactic wizards duel. But with so much competition in the field, it's harder than ever to think up original games.

Each designer has his own particular work habits and creative techniques. Miller loves sports, hence his first two games for Activision, *Ice Hockey* and *Tennis*. Crane, who's known as a graphic virtuoso, begins by creating visual images, then building a game around them. Sometimes a premise occurs to him like lightning striking the primordial soup, and the game evolves smoothly. More often, Crane says, designing video games is a process of eliminating every idea that doesn't fit, like a sculptor chipping away at a block of marble in search of a statue trapped within.

Occasionally, he just gets lucky. Crane was on his way to a trade show in Chicago when he saw a man trying to run across Lake Shore Drive's rush-hour traffic. "Hey, there's a good idea for a video game," he remembers thinking. It evolved into *Freeway*, and a cartridge that "went gold," selling more than half a million units. "But for how to hook everything up, the idea was there in ten minutes. That was fun," he says. "The rest was hard work."



Pitfall Harry, *the most popular 2600 character around.*

Once he's found an idea, Crane writes a brief description of how the game is supposed to play. Then he settles down in the lab and spends days alternately studying cloud formations out the window and writing detailed computer code in brief, intense bursts.

The process that creates a challenging game can be endlessly tedious. "You're giving extremely simple instructions to the microprocessor, telling it to take this number and move it over there. That's all I can do," Crane explains. "But if I can do 30 of those in a row, in the proper sequence, I can make something pretty fancy happen."

Though the Atari VCS is a comparatively crude first-generation game console, it's the de facto standard for the industry, with more than 12 million consoles sold. Because it requires a fair amount of programming skullduggery to produce a challenging game on the VCS, Crane and his colleagues have become adept at "crunching code," or squeezing as much information as possible into small computer memories by writing a kind of programming shorthand. "I often start a game by coming up with a new way to fool the machine, and seeing what kind of a game it will become. *Grand Prix* is an example. It was unthinkable before that to make a car the shape and color of those in *Grand Prix*. At the time I was doing *Grand Prix*, people were telling me there was no way to pack that much information into the limited amount of memory space we had available. So I did. So there!" He beams.

As the memory chips that are the brains of the games become more sophisticated, so does Crane's job. His recent, more complex games require as many as 4,000 separate instructions, which are physically "burned" onto computer chips to provide the look and playing features of the games.

Building cartridges is not only more profitable than building the computers that run them, it requires very little overhead beyond hiring the talents of a few brilliant games designers. Because the markup is so high—the raw materials of a cartridge that retails for $30 may cost only $5—one hit can generate as much money as a blockbuster movie.

Pull apart a game cartridge and you'll find mostly air. The plastic housing, slightly larger than a deck of cards, is empty except for a couple of clips or springs securing a wafer of green circuit board veined with the silver squiggles of solder traces, electrical pathways printed directly on the board in place of insulated wires. This is the component that plugs into the game console's circuitry, summoning up mirages on the TV screen.

The snap-together cartridges are manufactured in snap-together buildings. Red Spanish tile roofs and featureless sheet concrete walls are the vogue in Milpitas, where Activision produces its cartridges: There's no aesthetic distinction there between a branch bank, a bookstore, or a taco parlor. The buildings are assembled by tilt-up construction, probably the fastest and cheapest way of erecting a building yet devised. The walls are laid out facing the base, then tilted forward into place—and presto.

"In earthquakes, the walls fall away from the foundation," says one local executive. "That sounds great, until you think where the roof goes."

Labor in Activision's factory is cleaner, but no less monotonous, than work on any other assembly line. Several short conveyor belts carry the cartridge through a series of metamorphoses. The green circuit board is taken out of stock, fitted with bumpers, and loaded with the necessary components, in this case a ROM memory chip. The chip, which has been permanently imprinted with the game program, is encased in a rectangular black "bug" joined to the board by a score of silver legs through which it can communicate with the outside world. After the ROM is loaded, the boards march through an automatic soldering machine, a rinsing and cleaning device, and a drying area.

The company delegates its manufacturing work to Selectron, a specialty sub-contractor that also assembles cartridges for Imagic and other independent cartridge builders. About 75 Hispanic men and women assemble the units, plug them momentarily into a testing console, pack them with instructions, and store the boxes for shipping. No one on the line wears surgeon's gloves or hair nets. Those precautions, used to prevent contamination of chips during their manufacture, are unnecessary at this stage of the process. A rock and roll radio station blares a background beat for the work. A sign lettered with a marking pen offers inspiration: TODAY'S GOAL IS 76,000 UNITS.

The path that led David Crane to Silicon Valley began in childhood. "David was the kid who was always up in the attic fiddling with a crystal radio set or setting fire to his bedroom with a chemistry experiment," says Activision's Levy. He was a born tinkerer, and there was always something a bit looney about his creations. Crane's grandmother likes to tell the story about the summer he got the triple sunburn. He was twelve or thirteen and burned so severely that the skin peeled three times. That summer he built a gadget with an Erector set arranged so that he could back up to it, push a panel, and have his back sprayed with sunburn ointment.

Crane's older brother dabbled in chemistry, rocket fuel, and electronics, and young David developed a taste for science by looking over his shoulder. His introduction to electronics began extracurricularly around age twelve. "I tore apart radios and things like that. I got an old used TV for my thirteenth birthday. Dad paid $40 for that TV. I wired it so I could put the picture tube up in a cabinet and keep the controls down near the bed. Never quite got that to work well. Ended up putting it back together so that I could watch it."

His passion for the screwdriver and the soldering iron grew throughout his school years, and Nappanee, a freckle on the map near South Bend, offered few distractions. (When Crane talks about his youth, he mimics the tone of a Horatio Alger story of humble beginnings and grand adventures, declaiming, "I was born and raised in a small town in northern Indiana.") The B&O railroad ran through Nappanee, but, beyond watching the trains, visiting his father's kitchen cabinet factory, or watching the wheat grow, there wasn't a great deal for a bright young man to do. The nearest town of any consequence was 40 miles away.

"We didn't have a McDonald's," Crane recalls. "Only

Designers share a little row of cubicles without doors, each designed to contain one person.

recently have the big-name fast-food restaurants moved in. It was a pretty small town, but there was a good curriculum for electronics and computers, surprisingly. We had consolidated two school districts and therefore had a lot of money. We put together a school with a lot of brand-new stuff."

As Crane remembers it, he was always a terrifically smart kid. In high school he would ignore the textbooks, listen to the lectures, and advance from grade to grade. Though abstruse electronics commanded a lot of his attention, he was not a social misfit. He played tennis, and lettered four years. "I was not an overachiever. I just visited high school," he shrugs. But he learned to program computers in three languages and built his first computer at seventeen.

Crane graduated in 1972 and immediately entered the De Vry School of Technology in Phoenix, Arizona. It was, he says, his peak as an inventor. "If I needed anything, I'd build it." The appliances he built were not the sort most people could be said to need. He made a programmable rhythm section in 1972 when they were all but unheard of, a tic-tac-toe playing computer, using 72TTL integrated circuits ("it was a huge, monstrous box!"), and a click that could time millionths of a second between two events.

Crane required that device to hone his skills as a semi-pro Foosball player. "It was a professional hobby for a few years. There was a million dollars in prize money on the tour then. I'd cash my weekly paycheck from my electronics job to fly to some major city in the United States and play Foosball for two days, 24 hours a day. I'd occasionally win back air fare if I was lucky." He placed 64th in the nationals the first year he played.

The campus unrest of the early Seventies was at the farthest edge of his awareness. "I'm not concerned with current events," he says nonchalantly. "Anyway, I didn't attend a campus. De Vry was a two-story building that was 80 feet square, with 2,000 students. The courses lasted all morning or all afternoon. You stayed in one room and the teachers shuttled from class to class. The school went five days a week, forty-eight weeks a year, two weeks off in the summer, and two weeks off in the winter." Crane, bored with even this accelerated program, finished the four-year course in 33 months and went to work for National Semiconductor in 1975.

It was the middle of the worst recession for the electronics industry in the last decade. But National was a big company, and Crane was given carte blanche in the most profitable division, the Operational Amplifiers department, which produced a little chip that was a basic building block for a lot of circuitry. The 741, as the circuit was called, was selling by millions. Quality control for the circuits required someone to flip switches 1,024 times, while making measurements out the other end. Crane stepped in and built a computer system to do the repetitive testing.

Crane's tinkering baffled everyone at National. "The people there were not into computers. But the manager of the department knew this was the wave of the future, so he said, 'I like what you're doing. Keep it up.'" Unfortunately, the only person who could run the device was Crane. And he was on his way to Atari, after a chance meeting with Alan Miller on a tennis court convinced Crane Atari was the place for a bright young engineer to be. "My last official act at National was to write up a $30,000 purchase order on a system from Hewlett-Packard to replace mine, so they'd have documentation on it telling them how it does what it does."

In late '77, Atari was the engineer's equivalent of Disneyland. "We had a lot of fun," he says. "Warner had owned it for a while, but Nolan (Bushnell, the founder of Atari and creator of Pong) was still running it. He's an engineer, and he ran the company as an engineer would run it. It wasn't making any *money* as an engineer would run it," Crane laughs, "and that's why Warner bought it. But he would still isolate the engineering department. He'd say, 'You guys go over there and have a lot of fun. We'll come back and talk to you every once in a while.'"

Crane found ways to make the computer draw pictures on a TV screen that no one else can duplicate, but he decided within two years that he had no future at Atari. He dislikes talking about the experiences that caused him to leave. Other than to say that Atari "became too much like a big company," he prefers to keep silent.

Alan Miller, who worked closely with Crane throughout that period, is more forthcoming. He re-

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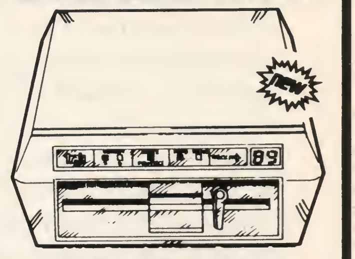

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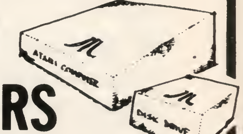

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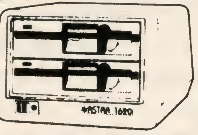

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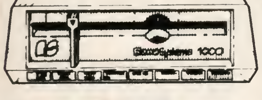

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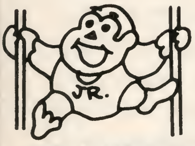

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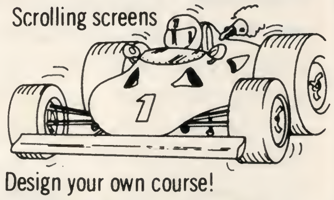

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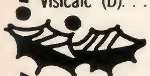

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sponded to an Atari help-wanted ad in a local paper when the company, preparing to introduce its VCS home video game system, urgently needed engineers to create game cartridges. Miller was to translate a moderately successful arcade game, *Surround*, into a home video version. He played the game in arcades, added some variations, and completed the project to everyone's satisfaction in about four months.

At Warner Communications, which had just purchased Bushnell's freewheeling organization, a number of designers became disenchanted. With the fun being squeezed out of their work, Miller and Crane grew restive. They resented a pay scale they considered below the industry average for engineers, anonymity, and supervision by people ignorant of the technical aspects of game design. "There is no way a person who's not familiar with the intricacies of an Atari 2600 VCS can assign and direct the production of games for it," Miller says with finality.

Miller, Crane, and two other Atari designers, who between them were responsible for more than half the company's cartridge sales, jumped ship to create their own software company. Activision became the first independent company producing games for the Atari VCS. Atari, needless to say, was upset, and sued the new company for $20 million, charging unfair competition and conspiracy to appropriate trade secrets. The suit was settled out of court last year. Since then, Activision has branched out, producing games for the Intellivision system. Privately held Activision now has about fifteen percent of the game-cartridge market, thanks in part to Crane's megahit *Pitfall*.

For adults and the few children in North America who have not seen Crane's hit game *Pitfall*, some explanation may be in order.

Pitfall is a race against time in a jungle setting. The player's alter ego, an animated stick figure called Pitfall Harry, runs through the wilderness, grabbing treasures, searching for shortcuts, leaping over marauding scorpions and cobra-rattlers (hybrid snakes found only in Crane's imagination), and grabbing jungle vines to swing over alligator pits. The idea is to get out of the jungle alive, with as much gold as you can carry.

If this sounds like a metaphor for contemporary life, that may help explain the game's popularity. *Pitfall* owned the number one spot on *Billboard's* best-seller list for four months last winter, including the high-volume Christmas season. It has dropped lower in recent weeks, but it's still going strong after well over a million sales. Clubs of *Pitfall* enthusiasts have been organized nationwide; there are almost 5,000 members in the Detroit metropolitan area alone.

Pitfall's graphics may also help to account for its success. Anyone familiar with the screen play of Atari's *Asteroids* or *Defender* will notice that the images in *Pitfall* do not flicker—a common occurrence in video games that display several objects on the screen at one time. Pitfall Harry is a detailed, almost humorous figure. In fact, Pitfall Harry looked cuter to consumers than E.T., the cuddly alien who had been expected to create a Christmas gold rush for Atari.

When Steven Spielberg's film made a meteoric showing at the box office, a phalanx of manufacturers descended on his offices to bid for the video game rights. Atari won and wasted no time in bringing its *E.T.* game to the home screen for Christmas. Implementing a special rapid production plan, the game was conceived, the program written, and the cartridges manufactured in a whirlwind sixteen weeks, a quarter of the time the process typically takes. Haste apparently made waste, however, because the game never made *Billboard's* Top 15. Madeline Gordon, general manager of San Jose's Microsel Distributing, Inc., said the game was a disaster for Atari. "I cancelled 15,000 (E.T.) pieces from Atari. It wasn't selling," she says.

To prevent similar debacles, Activision gives its designers a flexible work schedule many top executives might envy. The industry's short product cycles lend to many projects an atmosphere of crisis, so that the programming, which is intense work at best, becomes arduous. Without generous allowances for rest and recreation, designers can succumb to a long-term tiredness that spoils their work. Throughout the writing of the game program, a procedure that may take a year, they are usually unburdened by deadlines. "Some designers get writer's block, and they don't show up to work for a day or two at a time," says Levy. "But when they get an inspiration, they can work for hours on end."

Ideally, Levy continues, designers should be freed of "as many distractions as a rational world can allow." It's necessary to concentrate," says Crane. "When you do a video game, you have to keep a thousand different details in your brain at once to be sure everything's going to work when you get done. And any interruption will make you have to start over." To that end, the telephones in the design lab flicker a light, rather than ringing, to signal incoming calls. A polite but firm receptionist rebuffs virtually every attempt to communicate beyond the locked lab door, not even company memos circulate there. Less than ten non-designers have access to the lab, and the entire area has been made off limits to smokers. Even top management pales at the thought of intruding, let alone rushing the designers.

No one calls this pampering. It's just another example of the firm's benevolent paternalism. Levy takes pleasure in rewarding his people. A year ago, after Activision more than doubled its staff, Levy noticed that people weren't taking time to chat in the halls. To en-

As the memory chips that are the brains of the games become more sophisticated, so does Crane's job.

courage the employees to get to know each other, he flew the entire company to Hawaii for a week, a trip a local travel agent estimated cost more than $100,000. In such an organization, nobody cracks a whip over the creative staff.

"Time pressure makes the designer take short cuts," says sympathetic editorial director Tom Lopez. "It could turn a megahit into an average game."

Crane wouldn't know a time clock if he hit his head on one. "I get up at least by ten or ten-thirty every morning," he says with an expression just short of gloating. "If I've played a lot of tennis the night before, I'll sleep an extra hour just to rest my bones. I go into work about eleven, just in time to make the lunch crowd. Then I'll work through the afternoon, and, if it's a nice day, I'll go home to play tennis. While I'm waiting for a tennis court, I'll play video games.

"I could probably disappear for two or three days and nobody'd know I was gone. Eventually we have to have a little group approval on our games, when the other designers pass judgment, but a lot of it can be done by one person sitting alone at home. Some of the people will sit at home in a rocking chair writing code on paper for three solid days." The only way some people know he's at work, he says, is to look in the parking lot for the BMW with the personalized PITFALL license plates.

Nevertheless, Crane is the firm's most prolific designer. According to his coworkers, Crane is to programming what Evelyn Wood is to reading. He sits before a computer terminal, fixes its screen in a tunnelvision stare, and types in ten-minute bursts of pure microcode. Then he walks away and sips at his immense cola mug for a long time before returning for another ten-minute blitz. In those few minutes he accomplishes as much as other people might in an hour. He can bang out a finished game in three months, a speed few can equal.

"It's pretty intensive work. That's why I only do it a couple of hours every day. Because you've got to keep every little aspect of that circuit in your mind," he says.

Like obsessive authors who spend afternoons fretting over a comma, designers spend hundreds of hours polishing their games after most people would say it's done. "The last hundred hours are spent on details you might never notice," says Crane, holding his thumb and forefinger a hair apart. "Unbelievably teeny differences. Like in *Pitfall*, I made it easier for the guy to jump from a standing start. Originally you'd have to hit the joystick and the fire button right at the same time. Now, if you don't, the logic takes care of it. Just thinking about it, coming up with the idea and deciding to do it and getting it right took about a week. But it was a very important aspect of the game, making it play right."

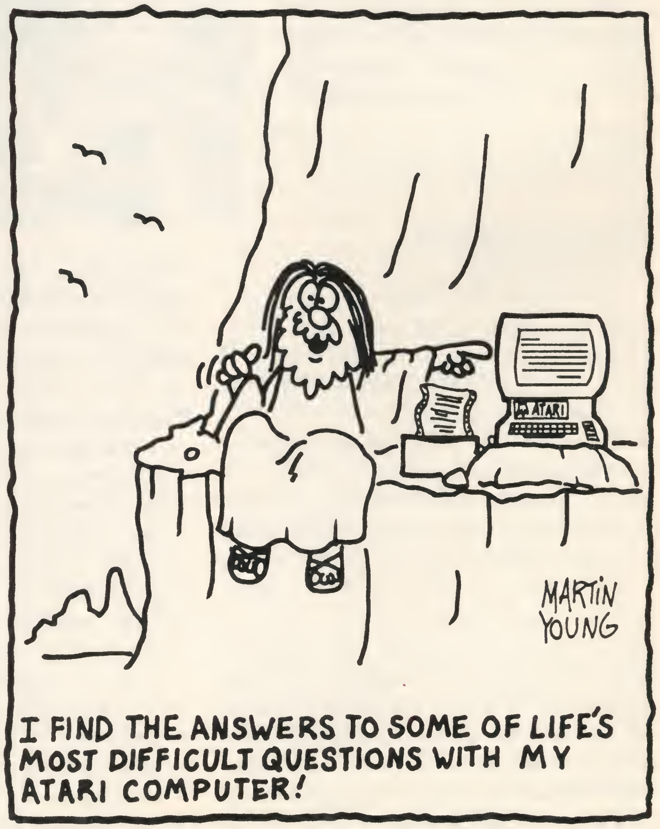
Still, even an experienced designer hits a fair share of dead ends. Crane estimates that 40 percent of his ideas go nowhere. "I have at least half a dozen almost-finished games that just weren't good enough. I've come back to one three times. I'm still going back to it because it's one of those games that feels like it ought to work. But I can't find out why it won't. Every game is different. Some don't have enough aspects of play, enough details; every time we trash one, the reason is different."

The qualities that make a good game are simple: "If it's fun for a half-dozen video game designers to play, it's a good game."

Today Crane is a celebrity of sorts. It seems only a matter of time before he appears on television brandishing an American Express card and asking, "Do you know my name?" Yet he doesn't consider himself a particularly noteworthy fellow. "There are a lot of people who like to play my games," he says with an aw-shucks smile. "They like to tell us that, and I like to hear that. It's always good to have recognition for work well done."

Mister Smith goes to Silicon Valley. It's the stuff of an uplifting Frank Capra movie. "I feel happy," he says, stretching his basketball player's legs contentedly. "I'm having a lot of fun. But I'd be enjoying myself no matter what I was doing, because I'd only be doing what I was enjoying."

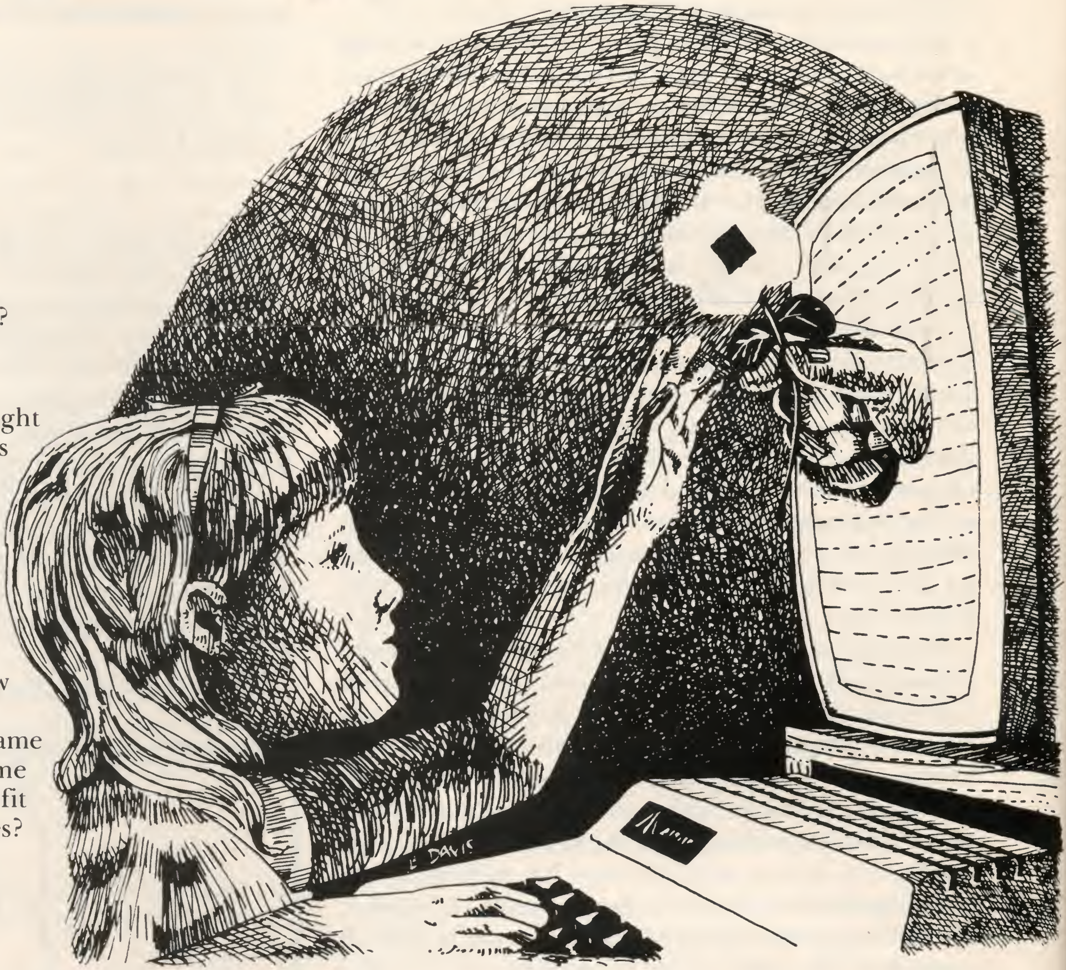
They used to hang people for having this much fun.



I FIND THE ANSWERS TO SOME OF LIFE'S MOST DIFFICULT QUESTIONS WITH MY ATARI COMPUTER!

Family Place

by Dorothy Heller



Does this sound familiar?

Dear Hi Res:

Ever since my spouse brought the computer home, things haven't been the same. One of our kids only comes to bed after hours of programming and has started to skip meals and eat stale tuna fish sandwiches. The other kids don't seem to be learning anything except how to kill enemy aliens.

Since that Atari computer came out of the family budget tell me please, how can all of us benefit from its computer capabilities?

Sincerely,
A New Computer Parent

Making Computing a Family Affair

Who uses the Atari in your family? Does everyone get their chance to use the computer, or:

- Is the Atari monopolized by kids blowing up planets?
- Does one of you feel like a computer widow/widower?
- Do you feel that your computer is a financial investment that isn't paying off?

Personal computing can open up exciting possibilities for you and every member of your family. Stay tuned! In this and future columns, We'll talk about:

- games that have general entertainment value—without using violence.
- educational games that children can enjoy and learn from, even non-readers, as young as three years old.
- how people who are limited by are limited by physical handicaps or family responsibilities, use their Atari for home learning and earnings.
- the exciting possibilities the Atari computer offers for career and personal development.
- how you can use your family computer for home management.
- evaluating games and educational software for your whole family.
- using your Atari for creative hobbies, such as art and music.
- Atari PILOT and Logo friendly programming languages for beginners and children.

Now, lets take a look at two games for 3-to-6-year olds from The Learning Company.

A software company in Portola Valley, California is challenging the stereotype of who uses computers. The Learning Company's founders, top managers, and many key members of the programming staff, are women. Ann Piestrup, Teri Perl, and Leslie Grimm are all educators and

---

Dorothy Heller is co-author of Computer Confidence: A Woman's Guide, *Acropolis Books Limited and* Free Software for your Atari Computer, *Enrich/Ohause. She is a freelance writer living in Cupertino, California.*

parents who believe that children as young as three years old can enjoy computers and learn with them. Their goal is to create learning games that take advantage of the computer's sound, graphics, and color capabilities, plus children's natural curiosity, instead of standardized "computer-assisted instruction" programs emphasizing question-and-answer drills. The Learning Company also believes that games can be fun and challenging without violence.

Two of their learning games are now available for the Atari 400/800/1200 computers. Juggle's Rainbow was first developed on the Apple computer; the other, *Juggle's House*, is an exclusive for Atari.

> *Their goal is to create learning games that take advantage of the computer's sound, graphics. . .*

Both are available on disk and cassette and come with attractive, illustrated instruction and activity booklets.

Juggle's Rainbow

"Juggles" offers a child several learning activities, with an option menu enabling the parent to regulate the speed of the games and use picture clues for very young children and non-readers.

The first learning activity is a rainbow game that teaches children the concepts of above and below. Blue paper strips come with the game you can place on the center row of the computer keyboard. That way the child learns to press keys above or below the blue strip and watch what happens on the screen.

Another activity is the butterfly game, to teach the child the concepts of right and left. In this game the parent places a blue strip extending from the sixth key at the top of the keyboard to the B key at the bottom. By watching the screen, the child learns to differentiate between left and right.

Juggle's Windmill, the third game, combines the child's learning experience, correlating the concepts of above left, above right, below left, and below right with screen graphics.

These games also include line-and-circle recreations to help the child recognize the letters b, d, p, and q, which are difficult for many children to distinguish.

Thomasina, our reviewer, a young lady about to celebrate her third birthday, enjoys and learns from *Juggle's Rainbow,* with a few minor difficulties. Because of her age, she requires some adult supervision and explanations. She also has a tendency to move the blue strips on the keyboard, and even chew on them ven chew on them while she is figuring out her next move!

Still, the game's colorful graphics and musical accompaniment give her positive reinforcements throughout. If she presses an above key inappropriately, when the game calls for below, the program displays "that was above" on the screen and gives her the chance to keep on trying.

Juggle's Rainbow seems to be very successfully child-proof, since the child can press on any combination of keys without making the program crash, and the Shift, Control, and Break keys don't respond at all. Thomasina did short-circuit herself a few times by leaning forward to touch graphics on the screen and inadvertently pressing the space bar. This simply starts the game again, or goes on to a new activity, but doesn't cause any program errors or "crashes."

Both Thomasina and even adults especially enjoy the picture games that climax each segment. By pressing any series of keys, the child creates a rainbow, butterfly, or windmill on the screen. As the child continues pressing keys, the rainbow or butterfly changes color, and the windmill goes around.

By the time Thomasina has played for about forty minutes, she has correlated above and beyond with the more familiar words of top and bottom, and responds appropriately when the games cue her. She also recognizes letters on the screen; left and right cues; and some of the letters on the keyboard.

Juggle's House

The format of *Juggle's House* is similar to *Juggle's Rainbow*. The parent also has the option to regulate the game's speed and the use of picture clues and blue divider strips for the keyboard.

But, instead of above, below, left and right, *Juggle's House* demonstrates the concepts of outside and inside. After the child has worked through several explore-and-review segments, a house appears on the screen. Pressing the keys inside the house, the child can make furniture appear in different rooms. Pressing the outside keys produces a tree, a dog, and other outside scenes. After the child has pressed ten keys, all the objects appear on the screen. Additional key presses animate the objects. The bird flies, the dog's tail wags, and smoke comes out of the chimney.

> *. . . tell me please, how can all of us benefit from its computer capabilities?*

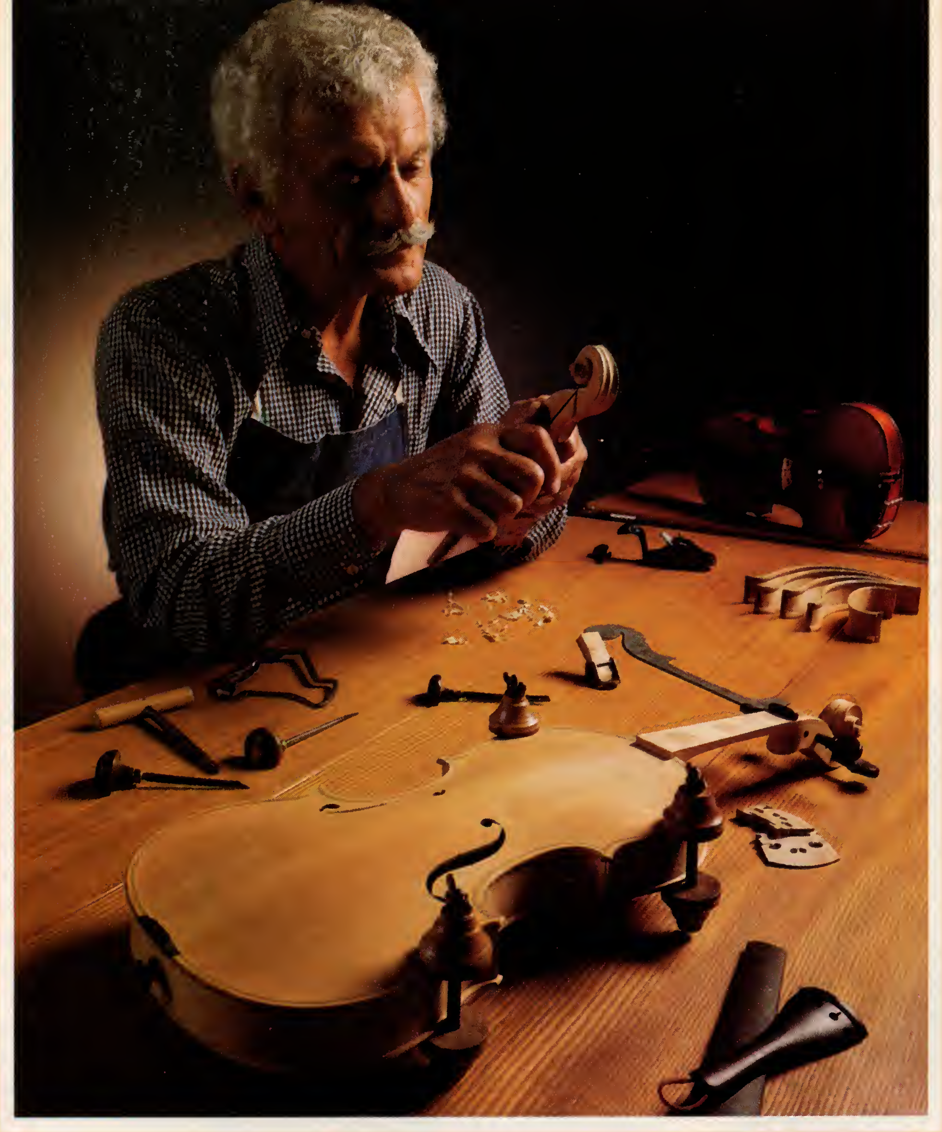
Juggle's Toyshelf demonstrates the concepts of upper and lower. When the child works through the explore-and-review segments, key presses make toys appear on the upper and lower shelves of the toyshelf. With more key presses, the child can make the toys rotate or match up.

In some ways, *Juggle's House* is even more appropriate for our young learner, since she can readily recognize and identify with the objects and scenes. With adult help, this game can be successful with children as young as two.

Back to Basics

The Learning Company actually presents some very sophisticated concepts in a game format. While the child plays, he or she is learning about the computer and the computer keyboard. She is learning the lessons contained in the games and beginning to think in terms of quadrants.

Juggle's Rainbow and *Juggle's House* demonstrate that educational software can be game-like and still communicate basic learning skills. Learning games are a new trend in software when children get to play computer games—only you know that they're also learning!



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Some Assembly Required

by Robert Peck

Last issue we explored some of the advantages of machine-language programming, most notably its speed. This issue I'll introduce you to hexadecimal notation, a number system, like binary (Base 2) or decimal (Base 10) that is the heart of machine language. Don't worry, Basic programmers, I'll stick to vocabulary that you may already know.

Despite the mystery which seems to shroud machine language, it is simply a series of numeric codes that tells a computer what job to perform and how. Unlike Basic, which is an interpretive language, machine language is understood and acted upon directly by the computer.

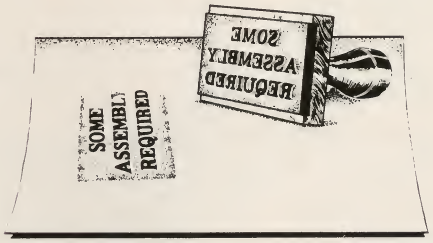
When you want the computer to do something for you, you have to tell it how to do the job. Consider sending a robot to the corner store for a loaf of bread.

Your robot's first question might be: "How is that job to be done?" You might respond "Drive to the store, get the bread and come back." But that's not enough data for a computer. Where's the car? How does he turn it on? What is bread and how do you pay for it? For that matter, what is a store?

You won't get away with simple instructions, unless your computer can infer from them all of the smaller steps that even the simplest financial transaction requires.

Think of these simple instructions as something called a "higher-level language," an interpretive language, much the way you and I communicate. But the computer can think only in small steps. These steps are the machine codes upon which the programmer builds to perform a higher level task. Given enough of these short instructions, the computer appears to "interpret" your most general wishes. All of this interpreting takes place in the central processing unit.

This central processing unit (CPU) can only understand numbers. These numbers may be used to represent letters of the alphabet, special characters, or other numbers.



Let's imagine the computer is a post office. Then let's think about the central processor as a mail clerk. This clerk is very efficient when he is told exactly what to do, and when to do it. But he's not very aggressive; he does only what he's told.

In front of him, is a set of mailboxes. His job is to sort the mail data into the correct box.

The clerk has his instructions written on a reference card. These instructions tell him, by number, exactly what to do. Here's what his card says:

1. Pick up a new envelope.
2. Read the name.
3. Read the address.
4. Read the zip code.
5. Compare the address on the envelope to those addresses on the mailboxes.
6. If the address is a match, then put it in the box.

If the clerk learns his job well, soon he'll know just what to do by the numbers. In other words, if he understands the numbers instantly, there is no need for him to read-and-interpret each of the sentences in order to get his job done. That's the difference in speed between an interpreter (Basic) and performing tasks by the numbers (as in a machine language program).

Let's carry the analogy one step further. If you were the postmaster and wanted to alter your clerk's list of duties you could rely on the same numbers. You might have to look up what the numbers represent in a list of your own, but this process is just like "assembling" a program. You only have to do it once, and your clerk (the central processor) can do the tasks at top speed each time he reads the list, even if it's in a different order.

The Importance of Hex

As you can see, numbers are important to the computer and to you as a programmer. In this column numbers will be written in hexadecimal. By using hexadecimal, you can express a value from zero to 255 in only two characters. The "two characters" are important, because the computer itself only understands binary.

Though binary may appear rather limited, given enough digits you can represent an infinite range of numbers. Here are the possible two-digit combinations:

Digit A	**Digit B**	
0	0	combination 00
0	1	combination 01
1	0	combination 10
1	1	combination 11

Each digit you add to the group doubles the different combinations of number sequences you can form. Three digits offer eight combinations; four digits offer 16 possible combinations. If there are eight digits, then 256 possible combinations from 0 0 0 0 0 0 0 0 (value 0) to 1 1 1 1 1 1 1 1 (value

---

Robert Peck is a regular contributor to Hi-Res.

255) can be formed. Your Atari is an eight-bit machine, which means it can read a data line eight digits long.

Let's see how that last combination of binary ones forms the decimal 255.

In the binary system, the first digit represents a zero or a one and every digit thereafter represents a power of two. Reading from right to left, the second digit, represents two raised to the first power, or two. The combination 1 1 in binary equals 2 + 1, or three, in decimal. Remember, you translate to decimal only those digits in the "on" condition. The eight-digit combination in our example represents "on" conditions for every power of two, up to 2(7) plus one.

1 1 1 1 1 1 1 1

128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = 255.

Since all values are considered "on," we find the sum of all values in the first row by adding them together. Therefore, 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = 255. While binary is rational to the computer, it's awkward for the rest of us. The number 130, for example is represented by the binary combination 0 1 0 1 0 0 0 0.

Instead of using all of those binary digits, hexadecimal numbers can be used as a shorter way of showing the same number. Hex bites off four binary digits (bits) at a time and represents their value with a hexadecimal value (Base 16 number system).

The hexadecimal system represents the first 16 decimal units by using 10 decimal digits (0-9), and the first six letters of the alphabet (A-F). Table 1 shows decimal (Base 10), binary (Base 2) and hexadecimal (Base 16) conversions.

Let's convert binary:

```
0 1 0 0   1 1 1 0

-------   -------
4 bits    4 bits
```

to hexadecimal. Hex treats each four-digit group separately. In other words, the left four digits are represented by possible decimal values one-to eight; so too are the right-most four bits.

Decimal	Binary	Hex
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A*
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

*Here hexadecimal starts using letters of the alphabet because we ran out of digits.

Table 1. Conversion from decimal to binary to hex.

8421	8421
0100	1110
4	14

According to the conversion table, decimal 4 = hexadecimal 4, and decimal 14 = hexadecimal E. So binary 0 1 0 0 1 1 1 0 = hex 4E. In decimal this represents 4x16 or 64, plus 14 or the decimal 78.

So this is the number system you will most often see in my column. It will be used because it is closer to the number system the computer uses than the decimal numbers we use normally.

Next time we'll continue the computer/clerk comparison and see some of the ways the computer keeps track of the job it is supposed to be doing.

The Academic

From page 19

$E-1/2MV^2$. A rotating flywheel has energy too, although it may not be moving anywhere, just rotating. What part of physics deals with the energy of moving matter?"

As the narrator talks, the text appears on your monitor, more or less in sync with the voice. Occasionally an illustration appears, crudely constructed out of the ATASCI character set.

At the end of the frame, two or three alternative answers to the narrator's question appear on the bottom of your screen. You respond by typing the numbers 1, 2 or 3 on the keyboard. If you respond incorrectly, you hear a nasty raspberry sound, and the frame remains on the screen, waiting for you to respond again. If you respond correctly, the lesson proceeds to the next frame, and the narrator's first phrase is a reinforcer such as "Right."

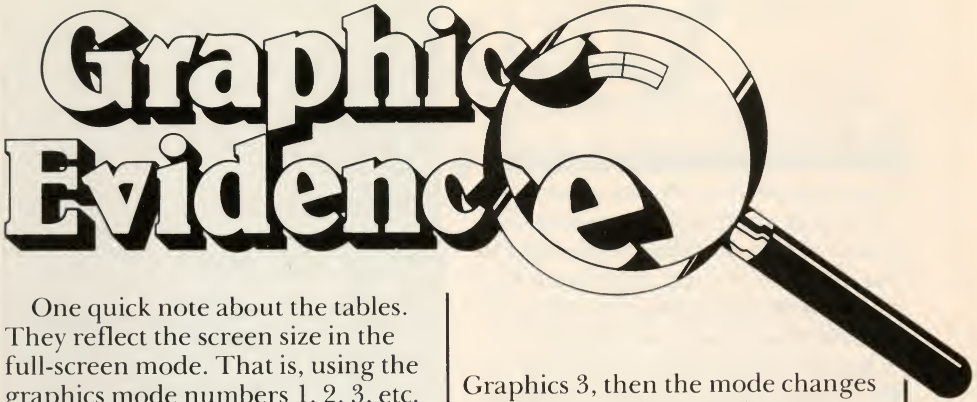
When I demonstrated "Vowel Sounds, " which is program 15 of "English as a Second Language," to the graduate class that I teach at Boston University, the class responded with catcalls—"It's boring!" or, "It doesn't use the medium appropriately." But one foreign student disagreed. "I wish I'd had that when I was learning English," she said.

In short, I'm not sure who'll learn what from the Dorsett material. Dorsett seems to have done to a host of interesting subjects what a decade of desert sun does to a bone. But if it's meat and potatoes that you're after or if all you want is a C- on a physics mid-term that you neglected to study for, maybe Dorsett can help you out. But Dorsett is not Plato, nor classical CAI at its best.

In future reviews we'll look at some of the alternatives to the classical approach to computer-assisted instruction.

by Tim McGuinness

Graphic Evidence



In my last column, we discussed the use of color and the various graphics modes available on your Atari 400 or 800. This month, we'll explore some of the different features of Atari's 1200XL; features we can expect on Atari's new line. At the end of the column, you'll find my preliminary memory map for the 1200XL, which I hope is of use to all.

First, lets talk quickly about compatibility. In most cases, all third party software will work on the new 1200. However, if your program is cartridge-based, you are out of luck. It's the cartridge slot itself on the 1200 that is really the problem. Most publishers, who produce third-party cartridges, will be changing their carts as quickly as possible to meet Atari's new needs.

Four New Graphics Modes

In the new 1200XL, Atari has added, or at least, given you access to four new graphics modes. Table 1 shows the 12 modes available on the 400/800.

Modes 0, 1 and 2 are character modes that allow you to display characters on the screen. Modes 3 through 8 are the Bit Map or drawing modes that allow you to plot data on the screen with the Plot and Drawto commands. The last three are the GTIA Bit Map modes.

Like the other Bit Map modes, the GTIA modes let you plot on the screen, but in mode 10 you can use eight colors, and in modes 9 and 11 you have 16 colors or luminances to choose from.

The "new modes" for the 1200XL were always a part of the 400/800, but you could only use them with special programs employing PEEKS and POKES. Table 2 shows the "new modes."

With the addition of these graphics modes you now have all but two of Atari's modes available to you.

One quick note about the tables. They reflect the screen size in the full-screen mode. That is, using the graphics mode numbers 1, 2, 3, etc. will give you a split-mode screen. The upper part of the screen is selected by the Graphics command, and the lower part is a Graphics Zero (0) text window. In all cases, except the GTIA modes, you can remove the text window by adding the value sixteen (16) to the graphics value: Example: Graphics 7 + 16 = Graphics 23

The above example provides a full-screen mode in Graphics Mode 7. One other useful feature is to add 32 to the graphics mode number. This allows you to go from one mode to another without clearing the screen each time. To observe these two features, type in the following short program, then run it. The program draws a box in Graphics 3, then the mode changes from 3 to 15. This will give you a quick idea of what the new modes look like.

```
 10 REM GRAPHICS MODE DEMO
 20 GRAPHICS 3
 30 PRINT "THIS IS GRAPHICS MODE
    3"
 40 COLOR 1:PLOT 2,2:DRAWTO 15,2
 50 COLOR 2:DRAWTO 15,10:DRAWTO
    2,10
 60 COLOR 1:DRAWTO 2,2
 70 FOR GRM = 3 TO 15
 80 GRAPHICS GRM + 32
 90 PRINT "THIS IS GRAPHICS MODE
    "PM;" + 32"
100 FOR WAIT = 1 TO 200:NEXT WAIT
110 NEXT GRM
120 GOTO 10
```

As you can see, this produces some interesting effects. It's useful

Gr.	Mode Type	Colors	Columns (Across)	Rows (Down)
12	Character	4	40	24
13	Character	4	40	12
14	Bit Map	2	160	192
15	Bit Map	4	160	192

Table 2. The 1200XL offers four new graphics modes.

Gr.	Mode Type	Colors	Columns (Across)	Rows (Down)
0	Character	2	40	24
1	Character	5	20	24
2	Character	5	20	12
3	Bit Map	4	40	24
4	Bit Map	2	80	48
5	Bit Map	4	80	48
6	Bit Map	2	160	96
7	Bit Map	4	160	96
8	Bit Map	2	320	192
9	GTIA Map	1/16L	80	192
10	GTIA Map	9	80	192
11	GTIA Map	16	80	192

Table 1. The 12 graphics modes available on the 400/800.

Tim McGuinness is a regular contributor to Hi-Res. *He is director of software development at Romox, Inc.*

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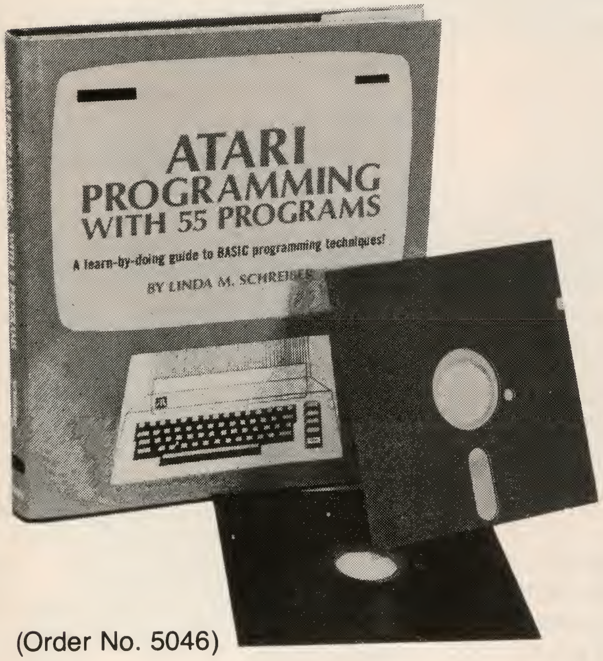
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Graphic Evidence

if you're interested in having an object expand or contract on the screen. Of course, it shifts both the horizontal and vertical positions because of the changes in format from one mode to next. Now let's examine the new 1200XL modes in detail.

Graphics 12

The first of the new modes is Graphics 12. This is a mode frequently used by Atari programmers. In the past, Graphics 12 was not available to the basic user. You can use it to display text. However, unlike modes 0, 1, and 2, which have a character size of 8x8 pixels, this character mode has only 4x8 pixels, that's half the resolution in the same amount of screen space. This is because these characters can each contain up to four colors, instead of one. That is, you may use three foreground colors, plus background. In fact, any of 256 . colors.

But this mode is used rarely to display text. Because of its four-color displays, Graphics 12 is used most often to provide multicolor playfields in a number of games. For example, Atari *Centipede*, and *Galaxian*, both use Graphics 12 for many of the screen objects.

Graphics 13

As in Graphics 12, Graphics 13 characters are also 4x8 and four color though somewhat larger. You are still permitted 40 characters per line, but only 12 vertical lines. This mode is most useful for redefining characters.

Graphics 14

This is the first of the new Bit-Map modes for the 1200XL. In this mode we have a two-color bit map 160 columns wide and 192 rows deep. Its pixel size is the same height as Graphics 8, but as wide as Graphics 7. The value of a reduced color mode is that you can display detail without using large amounts of screen memory. For example, the same display created in Graphics 8, recreated in Graphics 14 can save you almost 4K bytes of extra memory. In Graphics 15 the saving is more substantial. Graphics 15 employs the same size pixel as 14, but a full screen uses only half the memory.

Graphics 15

This is the special mode talked about in most magazines as Graphics 7+ or 7½. That is, the pixel is as tall as a Graphics 8 pixel and as wide as a Graphics 7 pixel. Therefore, it falls between 7 and 8. This is a true four-color mode. And—for those of you who are interested in such things—the pixel size of this mode is the same as the pixel size of the character mode 12. The screen size remains 160 columns by 192 rows down. This is the mode used by Datasoft's successful *Micropainter*.

The 1200 Difference

Atari's 1200 is offering programmers tools with which to work. We'll discuss other features in future columns. For those of you involved in higher level programming, I offer this short memory map for the 1200XL (Table 3.)

Hexadecimal	Decimal	Function
0000-007F	0-127	OS page zero RAM
0080-00FF	128-255	User page zero RAM Used with Basic
0100-01FF	256-511	6502 micro stack
0200-05FF	512-1535	OS RAM
0600-06FF	1536-1791	Free RAM
0700-1CFB	1792-7419	DOS
1CFC-9C1E	7420-39966	User RAM (Basic)
8000-BFFF	32768-49151	16K cartridge.
9C1F-9FFF	39967-40959	Display List/Screen RAM (Basic)
A000-BFFF	40960-49151	BASIC or other 8k Cartridge
C000-CBFF	49152-52223	OS ROM
CC00-CFFF	52224-53247	Int'l Char Set
D000-D0FF	53248-53503	GTIA registers
D100-D1FF	53504-53759	Reserved ???
D200-D2FF	53760-54015	POKEY registers
D300-D3FF	54016-54271	PIA registers
400-D4FF	54272-54527	ANTIC registers
D500-D7FF	54528-55295	Reserved ???
D800-DFFF	55296-57343	Floating Point
E000-E3FF	57344-58367	Normal Char Set
E400-FFFF	58368-65535	OS ROM

Table 3. Atari 1200 XL Memory Map

YOU ARE HERE
ALLAN K. JENSEN

Cryptics

Can you find & circle the 24 words or acronyms listed below?

```
O J U N K T H I S I S H A R D D
P P W Z F M D I S K E T T R S O
E R E Q L F U N C W L O K P J P
R O P R O G R A I M L Q O N Y P
A G R A A M E Q H I W D E R O E
T R E A P T I M P E U P O K R R
I A U M Y E I U A J T M E S J I
N M O B J C R N R H E A O E Y P
G S P X I Z Y I G M P B Z R K H
S U K S O F K I P S X P I O K E
X P A Q Y R L I G H Y F D T M R
S B A S I S C I K Z E S E C O A
R E A L T I M E G Q N R T F D M
D I S K E T T E Y H F Z A E E S
M E M O R O P E R A T I N L M X
X R W H T R O F V N Z K I O K P
R E L B M E S S A Y I T W O R D
F I L E P E E L X I O B A S Q V
M A R R M E P R O M B C E W R T
```

- Bit
- Dos
- Operating System
- Memory
- Rom
- Ram
- Eprom
- File
- Assembler
- Real Time
- Byte
- Basic
- Forth
- Modem
- Peripheral
- Diskette
- Word
- X10
- Program
- Peek
- Light Pen
- Graphics
- Pilot
- Poke

Advanced User Forum

Russ Wetmore

I'd like to discuss some philosophy. Before you get all excited, I don't mean Nietzscheism or the like, but rather *programming* philosophy. *How* you go about programming many times is as important as the work itself.

Zen and the Programmer

Basic is easy to learn, but its strongest feature—its interactiveness—can foster bad habits when carried over to assembly language (AL for short) programming: indeed, any language which requires assembling or compiling can.

Basic statements, when constructed properly, are grand expressions of ideas. Whole thoughts, whole processes are conceptualized in one line of program code. Statements as simple as:

```
10  GRAPHICS 7:PLOT 0,0:
    DRAWTO 50,50
```

represent a very complicated, very code-intensive operation to the computer. You don't have such luxury in AL. In its most base form the Basic program line above would easily translate to hundreds of lines of AL source code. What previously fit on one line of a terminal now occupies five, even 10 screens.

The point I'm trying to make is simple. No one can be expected to keep 100 pages of source code straight in their minds. Yes, 100 pages. Not counting the reference table listing, the source to *Preppie!* took 126 pages. Programs should be developed in small easy to maintain chunks.

And yes, I wholeheartedly recommend coding ON PAPER first, before reporting to the terminal to key it in. I've seen too many programmers content to do all their work, from start to finish, sitting in front of their computer terminals. For just this reason, for every program that somebody manages to squeak out this way, there are 50 potential programmers that will never make it.

> *Basic is easy to learn, but its strongest feature... can foster bad habits.*

I once mentioned this to a young programmer. His response was, "That's what computers are for." Baloney. When my computer is capable of showing me, all at once, what I can spread out on the top of my desk, then I'll believe it.

Biased Advice

You may or may not have heard of flowcharting, "treeing," top-down, bottom-up or inside-out programming. Well, let's add to the annals of programming history the "shuffled papers" method. Ta Da!

When I begin to program, I tend to break out my problem into a broad outline, written in English. I use "pseudo" programming constructs (If/Then/Else, Do/Until, etc.) to help me understand just what it is I'm trying to accomplish. Let's take an example.

I want to write a routine that converts a binary number to an ASCII string, remove any leading zeros, and store it to a buffer—supposedly for transferring to the screen later. My outline looks something like this:

```
BUFFER is 5 bytes long
NUMBER = number to translate
POSITION = 0

for PWR = 4 downto 0
   subtract 10^PWR from NUMBER, until
      NUMBER goes negative, counting
      each iteration
   make count an ASCII number (add $30)
   store number at POSITION in BUFFER
   inc POSITION
next PWR

clear out BUFFER with spaces
POSITION = 0

do while POSITION in BUFFER is "0" and
POSITION < 4 replace with a space
   inc POSITION
repeat
```

This outline makes several assumptions. For example, when we subtract 10^PWR from NUMBER, we don't want to end up with NUMBER being negative. This means either adding 10^PWR back to NUMBER to make it positive, or storing NUMBER away before each subtraction, as a precaution. Also, we certainly aren't going to use exponentiation to solve this simple problem. Instead we will build a table of values (we only need 5) and use PWR as the index to retrieve the value.

Russ Wetmore, author of the popular Preppie! *series heads Star Systems Software in Casselberry, Florida. He is contributing columnist to* Hi-Res.

Observant programmers will probably note that we can combine the first and second parts of the program into one, using a flag. Very well, there is always a better way of doing things. Our outline now becomes:

```
BUFFER is 5 bytes long
NUMBER = number to translate
POSITION = 0
FLAG = OFF
for PWR = 4 downto 0
   subtract 10^PWR from NUMBER, until
      NUMBER goes negative, counting
      each iteration
   if count = 0 and FLAG is OFF and PWR
   < > 0
   then DIGIT = space
   else DIGIT = count + $30
      FLAG = ON
   store DIGIT at POSITION in BUFFER
   inc POSITION
next PWR
```

After I am content that my basic logic is correct, I start to write codes. In AL our routine is shown in Program Listing 1.

NOTE 1: Notice that we are counting UP from zero to four instead of down as in the outline. There is a very good reason for this. In the outline we need to keep separate values for PWR and POSITION. Both numbers are in the range zero to four — they just travel in opposite directions. Since we are accessing a table to get our powers of 10, we can just turn the table UPSIDE DOWN, and then use one index variable for both. The 6502 only has two such index variables, and we are using one for our counter. This is a good example of tailoring your code to maximize the output for a particular microprocessor.

NOTE 2: A common mistake made by 6502 programmers involves tables of values longer than one byte in length. Many programmers build tables consecutively, such as:

```
DW 10000,1000,100,10,1
```

But the 6502 is an 8-bit oriented fellow, and page oriented to boot. The code necessary to access the above table is much more involved (Listing 2).

In most cases whatever we can do to keep down the number of indices needed, the better.

```
          ORG  $3000

; NOTE: This source is in Atari Macro Assembler (AMAC) format

; CALLING PROCEDURE:

;    Store binary value to be translated to NUMBER
;    Then, JSR BN2ASC

; USES:   All registers

; AFFECTS:   ZEROFLG, NUMBER, BUFFER

ZEROFLG   DS   1
NUMBER    DS   2
BUFFER    DS   5

BN2ASC    LDX  #0         ;X IS OUR "PWR" VARIABLE (SEE NOTE 1)
          STX  ZEROFLG    ;MARK AS NOT HAVING HAD A NON-ZERO NUMBER

B6        LDY  #0         ;Y IS OUR COUNTER

B3        LDA  NUMBER     ;SUBTRACT 10^PWR FROM NUMBER
          SEC
          SBC  PWR10L,X   ;(SEE NOTE 2)
          PHA             ;SAVE IN CASE NUMBER GOES NEGATIVE
          LDA  NUMBER+1
          SBC  PWR10H,X
          BCC  B2         ;CARRY IS CLEAR IF RESULT IS NEGATIVE

          STA  NUMBER+1   ;IT'S OKAY - STORE NEW RESULT BACK TO NUMBER
          PLA
          STA  NUMBER

          INY             ;BUMP COUNTER
          BPL  B3         ;UNCONDITIONAL BRANCH

B2        PLA             ;WHEN DONE, THERE'S GARBAGE ON THE STACK

          CPY  #0         ;IS COUNT ZERO?
          BNE  B4         ;NO, GO AHEAD

          CPX  #4         ;1'S POSITION? (WE NEED AT LEAST 1 "0")
          BNE  B4         ;NO, GO ON

          LDA  ZEROFLG    ;HAS THERE BEEN A NON-ZERO NUMBER YET?
          BNE  B4         ;YES, "0" IS OKAY

          LDA  #' '       ;MAKE IT A SPACE!
          BNE  B5         ;UNCONDITIONAL BRANCH

B4        TYA             ;MAKE COUNT ASCII
          CLC
          ADC  #'0'
          INC  ZEROFLG    ;MARK AS HAVING HAD A NON-ZERO NUMBER

B5        STA  BUFFER,X

          INX             ;DO UNTIL 5 NUMBERS
          CPX  #5
          BCC  B6

          RTS

PWR10L    DB   LOW 10000,LOW 1000,LOW 100,LOW 10,LOW 1
PWR10H    DB   HIGH 10000,HIGH 1000,HIGH 100,HIGH 10,HIGH 1
```

Program Listing 1. Assembly language routine to convert binary to an ASCII string.

```
        STX  TEMPX      ;SAVE X! IT WILL BE DESTROYED
        TXA
        ASL  A          ;MULTIPLY INDEX BY 2 FOR WORD OFFSET
        TAX             ; (TWO BYTES PER TABLE ENTRY)
        LDA  NUMBER     ;SUBTRACT 10^PWR FROM NUMBER
        SEC
        SBC  PWR10,X
        PHA             ;SAVE IN CASE NUMBER GOES NEGATIVE
        INX             ;(SEE NOTE 3)
        LDA  NUMBER+1
        SBC  PWR10,X
        LDX  TEMPX      ;LDX DOESN'T AFFECT CY FLAG
        BCC  B2         ;CARRY IS CLEAR IF RESULT IS NEGATIVE
```

Program Listing 2

NOTE 3: We could have eliminated this INX and simply written

SBC PWR10 + 1,X

the second time. Again, it pays to know your processor and how it addresses memory.

From Simple to Simpleton

Quite honestly, I can't keep straight all the things going on in a program. After writing 5000 lines of program code you're bound to forget a line or two. Usually it is something crucial that you'll spend hours looking for when things go wrong. Likewise when I attempt to write routines that spread over 10 sheets of paper, I tend to forget by the 10th page something I vowed to remember on the first.

> *A common mistake made by 6502 programmers involves tables of values longer than one byte in length.*

The example above was simple, but it's valid. By itself, it's a complete thought, but it isn't too demanding a programming exercise. However, if it's part of a much larger program, I'd just as soon not have to worry about such minor details until I have to. If I am trying to calculate the time remaining and print it to the screen in 40 colors at 42 places in the program, I don't want this mundane little pest confusing me even more.

When I am programming, I set one goal per day. I make it a goal that I can honestly meet and something that will give me some satisfaction (graphics, sounds, etc.)

What does this have to do with the example? Well, when I sit down, I draw out my outline. When I start coding, I limit all sections of code to no more than five pieces of paper. (I've found five pages is about my limit.) If I evolve a complex routine, something like BN2ASC, that becomes an idea by itself. I write it down as "JSR BN2ASC," and make a note that that routine has yet to be written. That rountine becomes its own five pages, and, in turn, will generate another five-page routine. If I find that I will only use the routine once I cross out the JSR line and, at the terminal, type the whole routine in its place.

I frequently find, while I'm writing, that I've already written a similar section of code in another module. Here's where the shuffling comes in. Since the original routine is seldom general enough to use as is, I make a note to start another five-page section when I'm done with the current one. Then, I cross out the original routine and put a big "JSR" beside it. Later, I go back and insert a sheet into the original with the changes necessary to access the new subroutine.

If this sounds like a lot of work, it is. But it helps me to keep everything straight.

Happy Trails

So much for how I do things. Lest anyone get the wrong impression, I am not advocating the way I program as a model for anyone to follow. Every programmer needs to find his own style.

As I said last issue, I'll be happy to answer any questions regarding your Atari computer. If you have a question send it to me in care of the address in the front of the magazine. We'll handle as many each issue as space will allow.

Also, I'll end this column each month with some things you may or may not know about your computer, and why they exist.

For example, you probably know that when your computer goes into "attract" mode (when you let it sit for awhile and it starts cycling through different colors) that you can stop it by pressing a key. What happens if you have a program running and it will take your key stroke as input? (How many times have you seen "PRESS ANY KEY TO ABORT" in a program?) Simple: Press [SHIFT] [CNTL] [A]. "Attract" will stop and no input will be registered.

Why?

Well, the operating system maintains a variable in memory called CH (764, or hex $2FC). When you press a key, it stops the computer for a second, jumps to a subroutine that reads the key, stores the key value to CH, then returns to what it was doing.

This value is NOT ASCII, but a code called an "internal" code. When no key has been pressed, CH holds 255 ($FF). When you call the "K:" handler (either directly, or through the screen editor) it examines CH, and if it isn't 255 the handler translates it to ASCII and returns. It just so happens that the internal code for [SHIFT][CNTL][A] is 255, so the computer doesn't know you've done anything.

Next time, we'll start a multi-part exploration of the Atari innards (ANTIC, POKEY, CTIA/GTIA) and how to make them stand up and do tricks.

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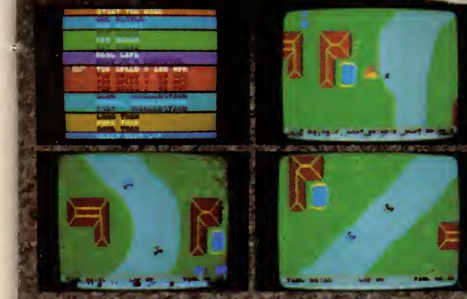

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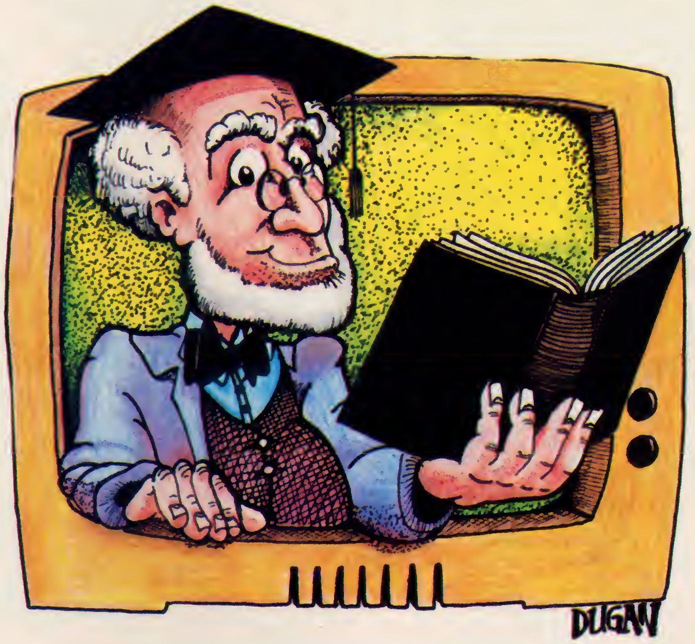
Strolling Forth

by Rosen & Maguire



Last issue we talked about why we like Forth, and why you might (or might not) enjoy it also. The hardest single task when first using Forth is just getting oriented. Questions like, "How do I start to attack a problem?"; "How is memory organized, and should I care?" and "How do I interface to the joysticks?" are common for novice programmers in any language. Moreover, since many new Forth users have first learned Basic, their "instincts" about how things are done can make learning Forth harder for them than for someone who has never programmed. In this issue, then, we'll talk not only about the code itself, but about the thoughts behind it.

Have you ever drawn pictures on the Atari Memo Pad using the control characters? Memo Pad appears when you turn on the Atari with no Basic cartridge.

Try it. Randomly type several lines of characters using only CTRL-F and CTRL-G; throw in some occasional CTRL-T's and spaces. What you get looks like a maze made of diagonal paths (the CTRL-F's and G's) surrounding some balls (the CTRL-T's) and some open spaces. This has possibilities. Bring up your version of Forth and we'll automate our doodling.

Doodling Forth

There are several ways to get a character, say "*," onto the screen. First, we can send it by saying ." *" which sends an asterisk to the next cursor position. This is similar to a Basic Print statement. Or we can type 42 EMIT, which is the ASCII code for an asterisk. Both of these methods go through the Atari ROM operating system, which on the 400/800 is rather slow. So instead we'll POKE directly into video memory to bypass the Operating System. But what do we POKE, and where?

In normal graphics modes the memory location 88 contains the address of the upper left corner of video memory. We'll send all the characters in the ROM set to the screen in code order and pick out the ones we want by hand. Define a word, call it Showme, as follows:

```
:  SHOWME
   256  0
   DO I 88 @ I + C!
   LOOP ;
```

Now position the cursor roughly halfway down the screen so it won't interfere with the display. Type Showme and the characters appear. Showme is a Do Loop that starts at 0 and ends at 255. For each numeral between 0 and 255 the program stores the Loop index I into the next video memory location. Showme computes the next memory location by adding I to the address at 88, and the characters are displayed starting at the upper left of the display.

For our maze we want the blank character, the two slanted lines, and the ball. You'll find the blank in the upper left corner of the display. Its screen code is zero. The two slants are toward the right end of the second line. Their codes are 70 and 71. The ball is 84. We'll put these codes in a reference table.

We can construct a single-purpose lookup table for just these codes, but instead we'll define a more general word called Byte-Lookup, which you can use for making byte lookup tables for any purpose. Since a Byte-Lookup employs Forth's Complex Builds Does command, we'll skip the explanation here. (If you'd like such an article, please write the editor!)

```
:  BYTE-LOOKUP
   <BUILDS DOES> + C@ ;

BYTE-LOOKUP   BOARD-FIGS
 0 C, 70 C, 71 C, 84 C,
 0 C,  0 C,  0 C,  0 C,
70 C, 70 C, 70 C, 70 C,
71 C, 71 C, 71 C, 71 C,
```

In the above, we define Byte-Lookup and then use it to define our table called Board-Figs. "Board Figures has 16 one-byte entries. The first four entries are the necessary screen codes. We'll add four blanks, and four extra of each of the slants as well.

Board-Figs, or any other word defined using Byte-Lookup, will take one stack argument and return the value of the corresponding element in its table. You can put any number of elements into the table as long as you use the letter C, just as we have here.

Next, let's write a word that will select an element from Board-Figs at

---

Evan Rosen & Steve Maquire are the co-creators of Valforth and will be writing monthly for Hi-Res. *Their co-hort, Dr. Quatro, will field any Forth questions.*

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random. This word will substitute for the random typing we did earlier in Memo Pad.

```
: PICK-BF
   53770 C@ 15 AND BOARD-FIGS ;
```

Pretty simple. Pick-BF, for "pick a board figure," delivers a random byte to the stack from the location 53770, which is a hardware random-byte generator. Pick-BF then ANDs this number with 15 to pick off the low four bits, creating a number from 0 to 15. The resulting number is used as a random index to the Board-Figs table which returns one of our characters. Now, we're ready to make our first game board.

```
88 @ CONSTANT   TOPLEFT
TOPLEFT   960 +   BOTRIGHT
: MAKE-BOARD
   BOTRIGHT   TOPLEFT
   DO PICK-BF  I  C!
   LOOP ;
```

We define the constant Topleft because it's faster and takes less space than repeatedly saying 88@. Botright is defined for similar reasons. (Botright actually points one byte past the end of video memory. This is more convenient.) Make-Board starts at the top left corner of memory and fills the entire screen with our four characters. The characters appear in proportion to their presence in the Board-Figs table. You can test the screen by typing Make-Board. The "OK" prompt that appears in the middle of the display wouldn't be there if you were running the program.

Your board should look interesting. Roads go every which way, and balls or dots are tucked in here and there.

The Wumpus Game

Let's make the screen into a kind of solitaire maze-capture game, in which a joystick-controlled Wumpus runs along the lines and collects balls. We need some rules. Let's say that if Wumpus is over a diagonal, then he can only move in the two directions pointed to by the diagonal. But if Wumpus is on a blank it can move up, down, left, right, but *not* diagonally. If you land Wumpus on a ball, you score a point. The ball will disappear, and then, since Wumpus is sitting on a blank, he can move again up, down, left or right.

What about edges? How about connecting the edges so that if Wumpus goes off the left or right, he reappears on the other side of the screen? Let's do the same with the top and bottom.

Let's put a one-minute time-limit on a round of play. After that the score will be displayed and the player will be asked if he or she wants to play again.

We've tested the game on Valforth, APX Forth, and QS Forth. You Fig-Forth owners should be able to edit it onto screens, load it, and run it as well. To run the game, enter the name of the last word, DOT-MAZE.

Since most 400/800 Forths don't allow you to interface with a joystick we'll examine that first. You can use a number of approaches to the Stick construction. Stick should take one argument, which is the number of the stick you want to read, and return two arguments, x and y:

X should be second on the stack or the "side-to-side" displacement being read from the stick. Leave -1 for left, 0 for center and 1 for right. At the top of stack should be the y, or "up-and-down" displacement, with -1 for up, 0 for center and 1 for down. The reason that "up" is negative is that moving an image upward on the screen involves working from higher memory into lower memory.

The 400/800 joysticks are read into locations 632, 633, 634 and 635. Only the low four bits of each location have meaning, one for each direction. A bit is 0 if its corresponding switch is closed, and 1 if it is open. With some testing on a real stick, we find that the word Stick works properly when defined as on screen 13 in the listing.

Now, about Wumpus. Let's keep him simple. His location in the maze will be tracked using inverse video. To invert the video set the high bit of whatever square he happens to be over. That way, you can still see which way the map under Wumpus is pointing. We'll hold Wumpus's position, its address in video memory, in a variable called WUMPUS.

How do we move this inverse video image through video memory without letting it run rampant through the rest of the computer? Look at screen 14, at the definition of MOVE-WUMPUS.

The variable DY contains the up/down value read from the joystick by another word, GET-STICK. DX contains the left/right value. Since there are 40 characters to a line, we multiply the DY value by 40, and then add the DX value to find the displacement. Because display memory is continuous, we can get away with this: As we go off the right side of the screen, we'll reappear on the left side on the next row down; if we go off the left edge, we come back a row higher on the right side.

But what if we go off the top or bottom? Then we'd be in forbidden memory. So, after we add 40 times DY and DX to WUMPUS, we check to see if we've gotten to Botright or higher. If so, we back up 960 characters. This puts us somewhere near the top left. Then, we check to see if we've gone lower in memory than TOPLEFT, and, if so, we move forward the 960 bytes instead, placing us near the bottom of the screen.

Finally, we want to move the screen image. When the program reaches the Endif on screen 14, line 9, the new address of Wumpus is on the stack. We ignore it for the moment, while WUMPUS @ 128 TOGGLE inverses the image of the old position by toggling its high bit. This returns the address to normal video. Line 10, DUP 128 TOGGLE, makes an extra copy of that new Wumpus address, inversing the video image there. Lastly, we store the remaining copy of the new Wumpus address into WUMPUS, moving him on screen.

Next issue, we'll talk more about the code. Until then, try your hand at the maze. Duration changes the game's length and the value of Stick-Delay changes the stick response by Stick-Delay. By changing any two of the zeros in the Board-Figs table to a 71 and a 72, you can make the maze much more difficult to thread.

70

```
Screen:  10
  0 ( CONSTANTS AND VARIABLES         )
  1
  2 88 @ CONSTANT TOPLEFT
  3 TOPLEFT 960 + CONSTANT BOTRIGHT
  4
  5   15 VARIABLE DURATION
  6   25 VARIABLE STICK-DELAY
  7
  8    0 VARIABLE STICK-COUNT
  9    0 VARIABLE HIGH-SCORE
 10    0 VARIABLE POINTS
 11    0 VARIABLE DX
 12    0 VARIABLE DY
 13    0 VARIABLE WUMPUS
 14 : 2DUP OVER OVER ;
 15 : NOT 0= ;                     -->
```

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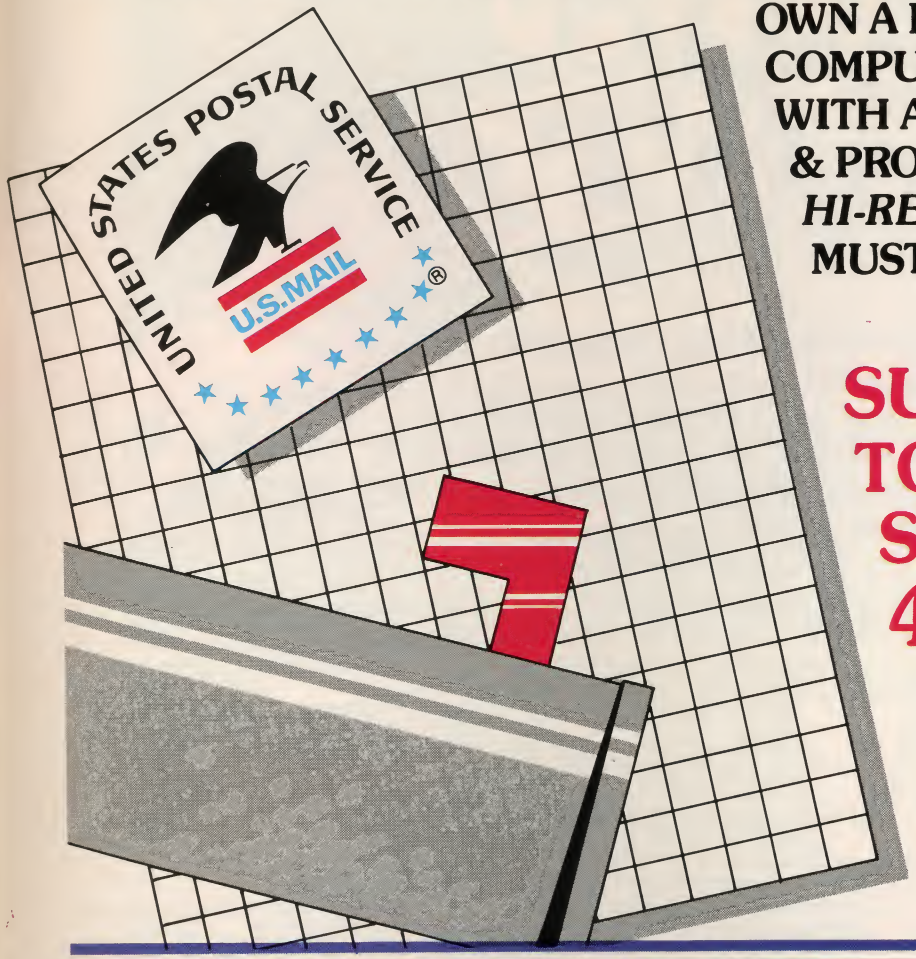
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authorized signature ____________________ random. This word will substitute for the random typing we did earlier in Memo Pad.

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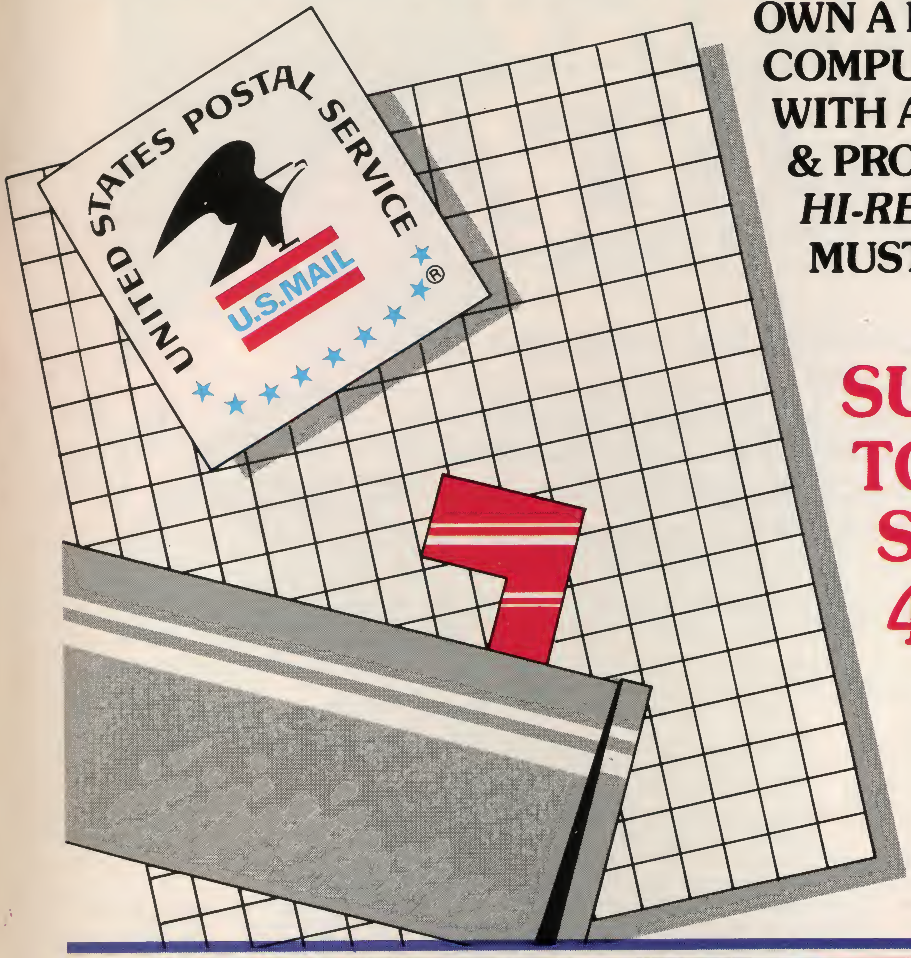
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Screen Listings For WUMPUS In Forth

```
Screen:  11
 ( BYTE-LOOKUP  BOARD-FIGS      )

 : BYTE-LOOKUP
    <BUILDS DOES> + C@ ;

BYTE-LOOKUP BOARD-FIGS
 00 C,   70 C,   71 C,   84 C,
 00 C,   00 C,   00 C,   00 C,
 70 C,   70 C,   70 C,   70 C,
 71 C,   71 C,   71 C,   71 C,






                               -->
```

```
Screen:  12
 ( PICK-BF  MAKE-BOARD          )

 : PICK-BF
   53770 C@ 15 AND BOARD-FIGS ;

 : MAKE-BOARD
   BOTRIGHT TOPLEFT
   DO PICK-BF I C!
   LOOP ;







                               -->
```

```
Screen:  13
 ( STICK                        )

 : STICK ( N -- L/R U/D )
   632 + C@ >R R 8 AND 0=
   IF 1    ( RIGHT )
   ELSE R 4 AND 0=
    IF -1 ( LEFT )
    ELSE 0
    ENDIF
   ENDIF R 1 AND 0=
   IF -1   ( UP )
   ELSE R 2 AND 0=
    IF 1   ( DOWN )
    ELSE 0
    ENDIF
   ENDIF R> DROP ;             -->
```

```
Screen:  14
 ( MOVE-WUMPUS  DOT-CHECK       )

 : MOVE-WUMPUS ( -- )
   DY @ 40 * DX @ +
   WUMPUS @ + DUP
   BOTRIGHT U< NOT
   IF 960 -
   ENDIF DUP TOPLEFT U<
   IF 960 +
   ENDIF WUMPUS @ 128 TOGGLE
   DUP 128 TOGGLE WUMPUS ! ;

 : DOT-CHECK ( -- )
   WUMPUS @ C@ 212 = ( 84 + 128 )
   IF 128 WUMPUS @ C! 1 POINTS +!
   ENDIF ;                     -->
```

```
Screen:  15
 ( MOVE-OK?                     )

 : MOVE-OK? ( -- F )
   DX @ DY @ AND
   IF DX @ DY @ =
    WUMPUS @ C@ 199 = OVER AND
    WUMPUS @ C@ 198 = ROT NOT AND
    OR
   ELSE WUMPUS @ C@ 128 =
   ENDIF ;






                               -->
```

```
Screen:  16
 ( GET-STICK                    )

 : GET-STICK ( -- )
   0 STICK 2DUP DY ! DX !
   2DUP OR ROT ROT AND NOT AND
   WUMPUS @ C@ 128 = AND
   IF STICK-COUNT @ 0= NOT
    IF -1 STICK-COUNT +!
     0 DX ! 0 DY !
    ELSE STICK-DELAY @
     STICK-COUNT !
    ENDIF
   ENDIF ;



                               -->
```

```
Screen:  17
 ( PICK-ONE  INITIALIZE         )

 : PICK-ONE ( N -- N )
   53770 C@ 256 *
   53770 C@ +
   U* SWAP DROP ;

 : INITIALIZE ( -- )
   0 STICK-COUNT !
   0 POINTS !
   960 PICK-ONE
   TOPLEFT + DUP
   WUMPUS ! 128 TOGGLE ;



                               -->
```

```
Screen:  18
 ( SHOW-SCORES  FINISHED?       )

 : SHOW-SCORES ( -- )
   HIGH-SCORE @ POINTS @
   MAX HIGH-SCORE !
   125 EMIT CR CR CR CR
   3 SPACES
   ." YOUR SCORE: "
   POINTS @ 4 .R
   CR CR 3 SPACES
   ." HIGH SCORE: "
   HIGH-SCORE @ 4 .R CR CR ;

 : FINISHED? ( -- F )
   3 SPACES ." TRY AGAIN? (Y/N) "
   KEY 223 AND 89 = NOT ;      -->
```

```
Screen:  19
 ( DOT-MAZE                     )

 : DOT-MAZE ( -- )
   0 HIGH-SCORE !
   BEGIN MAKE-BOARD INITIALIZE
    DURATION @ 0
    DO 1000 0
     DO DOT-CHECK
      GET-STICK MOVE-OK?
      IF MOVE-WUMPUS ENDIF
      764 C@ 255 = NOT
      IF LEAVE ENDIF
     LOOP
    LOOP SHOW-SCORES
    FINISHED?
   UNTIL 125 EMIT ;
```

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Kids and the Atari **from Datamost introduces Atari Basic Programming to children aged 10 to 14. Arranged in 33 lessons, the book contains notes to the instructor or parents, examples, assignments and review questions.**

Beginning with elementary vocabulary, the book moves quickly to writing simple programs, then emphasizes more advanced and powerful commands.

Hi-Res Magazine believes the study of programming enhances a child's learning experiences and wants to acquaint its readers with a valuable learning tool. We'll be presenting a lesson from *Kids and the Atari* each month over the next few issues.

Kids and the Atari was written by Ed Carlson who holds a Ph.D. in physics from John Hopkins. He is a member of the Department of Physics and Astronomy at Michigan State University.

Kids and the Atari is published by Datamost, Inc. 8943 Fullbright Ave., Chatsworth, CA 91311.

—*Eds.*

INTRODUCTION

INSTRUCTOR NOTES 1

PRINT, NEW, REM, AND RUN

This lesson is an introduction to the computer.

The contents of the lesson:

1. Turning on the computer.
2. Typing verses entering commands or lines. RETURN key.
3. The computer only understands a limited number of commands.
4. In this lesson, NEW, PRINT, REM, RUN.
5. What a program is. Numbered lines.
6. Clearing the screen.
7. Memory can be cleared with NEW.
8. What is seen on the screen and what is in memory are different. This may be a hard concept for the student to grasp at first.
9. RUN makes the computer go to memory, look at the commands in the lines (in order) and perform the commands.
10. One can skip numbers in choosing line numbers, and why one may want to do so.

QUESTIONS

1. Write a program that will print your name.
2. Run it.
3. Make the program disappear from the TV screen but stay in memory.
4. Run it again.
5. Erase the program from memory.

LESSON 1

PRINT, NEW, REM, AND RUN

Getting Started

Put the BASIC COMPUTING LANGUAGE cartridge in the ATARI computer. The label side is toward you. If you have an ATARI 800, put the cartridge in the left slot.

Turn on the computer. You will see:

```
READY
```

Below READY is a square. This square is called the "cursor." When you see it on the screen, the computer wants you to type something.

"Cursor" means "runner." The square runs along the screen showing where the next letter you type will appear.

TYPING

Type some things. What you type shows on the TV screen.

ERASING THE SCREEN

Two keys together erase the TV screen.

Hold down one of the SHIFT keys and press the CLEAR key. The screen is erased.

CLEAR stands for "clear the screen." "Clear" means the same as "erase."

COMMAND THE COMPUTER

Try this. Type:

```
GIVE ME CANDY
```

and press the RETURN key.

The computer says:

```
ERROR- GIVE ME CANDY
```

The computer only understands about 80 words. You need to learn which words the computer understands.

Here are the first four words to learn:

`NEW,PRINT,REM` and `RUN.`

THE NEW COMMAND

Type:

```
NEW
```

and press return RETURN.

NEW empties the computer's memory so you can put your program in it. It doesn't erase anything from the TV screen.

HOW TO ENTER A LINE

When we say "enter" we will always mean to do these two things.

1. type a line
2. then press the RETURN key.

Enter this line:

```
10 PRINT "HI"
```

(The " marks are quotation marks. To make quotation marks, hold down the SHIFT key and press the key that has the 2 and the " on it.)

(Did you remember to press the RETURN key at the end of the line?)

Now line number 10 is in the computer's memory. It will stay in memory until you enter the NEW command, or until you turn off the computer. Line 10 is a very short program.

THE NUMBER ZERO AND THE LETTER "O"

The computer always writes the zero like this:

```
zero        0
```

and the letter O like this:

```
letter O    O
```

You have to be careful to do the same.

```
right       10 PRINT "HI"
wrong       1O PRINT "HI"
```

WHAT IS A PROGRAM?

A program is a list of commands you wish the computer to do. The commands are written in lines. Each line starts with a number. The program you entered above has only one line.

HOW TO RUN A PROGRAM

A moment ago you put this program in memory:

```
10 PRINT "HI"
```

Now enter:

```
RUN
```

(Did you remember to press the RETURN key?)

The RUN command tells the computer to look in its memory for a program and then to obey the commands it reads in the lines.

Did the computer obey the PRINT command? The PRINT command tells the computer to print whatever is between the quotation marks. The computer printed:

```
HI
```

A LONGER PROGRAM

Clear the memory with:

```
NEW
```

(Did you remember to press RETURN afterward?)

Enter this program:

```
1 REM PROGRAM
2 PRINT "HI"
3 PRINT "FRIEND"
```

This program has three lines. Each line starts with a command.

Enter:

```
RUN
```

Line 1—the computer skips this line because it is a REM.
Line 2—the computer prints "HI."
Line 3—then computer prints "FRIEND." The REM command lets you put little notes to yourself in the program. REM means "remark" or "reminder."

In line 1 we used REM to give a name to the program. The name is "PROGRAM 1." The computer does the commands in the lines. It starts with the lowest line number and goes down the list in order.

HOW TO NUMBER THE LINES IN A PROGRAM

Usually you will skip numbers when writing the program.

Like this:

```
10 REM PROGRAM 1
20 PRINT "HI"
30 PRINT "FRIEND"
```

It is the same program but has different numbers. The numbers are in order, but some numbers are skipped. You skip numbers so that you can put new lines in between the old lines later if the program needs fixing.

Assignment 1:

1. Show how to "clear the screen."
2. Use the command NEW. Explain what it does.
3. Write a program that uses REM once and PRINT twice. Then use the RUN command to make the program obey the commands.

Lesson 2 Next Month

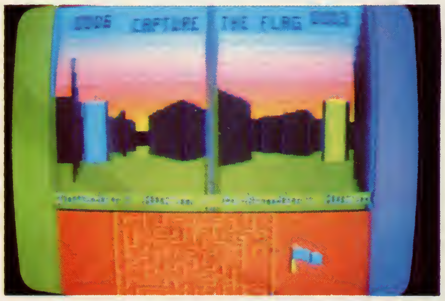
Previews

Perspective Maze

Complete with music and color graphics, Sirius has released *Capture the Flag*, a two-player maze and chase game for the Atari computers.

Each player occupies a different section of the play field and has his own 3D view of the maze. You must find the exit and avoid capture by your opponent. Suggested retail price is $39.95.

Sirius Software, Inc., 10364 Rockingham Dr., Sacramento, CA 95827.



Capture the Flag *from Sirius*

Update your SAM and Other Goodies from Don't Ask

Don't Ask Software has added two sound controls called KNOBS to their Software Automatic Mouth (SAM). KNOBS sound like a variety of different people, a small child to an extraterrestrial. If you already own SAM, you're entitled to the update for a small fee.

Chatterbee is a talking game that teaches spelling to school age children. A built in version of SAM pronounces spelling words and uses them in spoken sentences. Suggested retail price is $49.95.

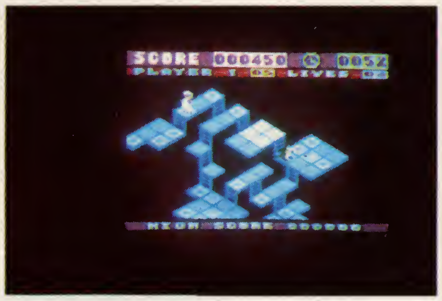
pm Animator is a graphic utility that allows programmers to create smooth high-quality player missile graphics from basic. With the *Animator's* editor, you can draw or edit pictures using a joystick or the keyboard. The *pm Animator* comes with all machine language subroutines necessary for incorporating the pictures into a Basic program. Demonstration programs and documentation are included in the $44.95 price.

Don't Ask Software, 2265 Westwood Blvd., Suite B-150, Los Angeles, CA 90064.

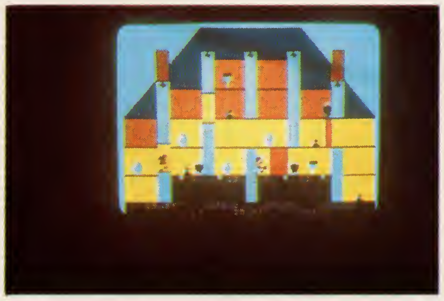
Three new games From First Star

Flip and Flop is one of three new games for the Atari from First Star Software. In this three-dimensional game, developed by James Nangano, you put your reflexes to the test.

In *Bristles*, by Fernando Herrera, you are commissioned to paint eight different dwellings while avoiding the Smart Bucket, Dumb Buckets and Flying Half-Pints.



Flip and Flop *by First Star Software, Inc.*



Bristles *from First Star Software, Inc.*

Complete with six musical themes, a self-playing mode and a game logo, *Boing!* is available only on cartridge.

For further information contact First Star Software, Inc., 22 East 41st St., New York, N.Y. 10017.

Avalon Hill Creates Video Game Division

Avalon Hill's new video game division released its first three titles for the 2600.

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London Blitz *by Avalon Hill*

London Blitz is a real-time, eye-hand, coordination game that has you run around the streets of London locating UXBs (unexploded bombs). *Death Trap*, a "zap-em" strategy game, and *Wall Ball*, a 3D racquetball game with nine levels of difficulty.

For more information contact The Avalon Hill Video Game Co., 4517 Harford Rd., Baltimore, MD 21214.

Educational Software From Krell

Connections is one of four educational products from Krell that offers children of all ages entertainment and intellectual challenge. Included in the program is a set of data bases dealing with geography, chemistry, mammals, mathematics, tools, and everyday objects. The program retails for $99.95.

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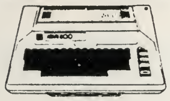

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Other entries from Krell include *Plato's Cave* (49.95), *Alexander the Great* (39.95), and *Galactic Magician* (34.95).

Krell Software Corp., 1320 Stony Brook Rd., Stony Brook, New York, NY 11790.

The Inexpensive Spreadsheet

Home-Calc turns your Atari home computer into a business calculator. The inexpensive spreadsheet program can handle "what if?, how much?, and bottom line" calculations.

Home Calc works on the new XL series computers and the Atari 400/800. Available on cassette (16k) or disk (24k), *Home-Calc* costs $29.95 and $39.95 respectively.

Sim Computer Products, Inc., 1100 E. Hector St., Whitemarsh, PA 19428.

More Help from Percom

The Percom "Doubler" requires no special tools to install and doubles the storage capacity of the AT88 from Atari. The retail price is $169.95.

Percom also released its new family of double-density disk drives containing a parallel printer port. With these drives, you can attach a parallel printer to your Atari while by-passing the 850 Interface Module. The AT88-S1-PD is a single drive that retails for $529. The AT88-S2-PD is a double-drive that retails for $829.

Percom Data, 11220 Pagemill Rd., Dallas, TX 75243.

Three releases from Thorn EMI

Orc Attack is one of three new games for the Atari from EMI. The 400/800 cartridge pits the Orc warriors armed with crossbows against your castle.

In *Computer War*, a player finds himself faced with saving the world from a nuclear holocaust. It's up to you to crack the code and destroy the advancing missiles before they destroy your world.

River Rescue, previously released for the VIC 20, is now available for the Atari 400/800.

For further information contact Thorn EMI Home Video, 110 East 59th St., New York, NY 10022.

Two VCS Games from CBS

Blueprint from CBS puts your memory to the test finding parts of a contraption that will halt the villainous, Ollie Ogre, in his tracks. *Solar Fox* invites you to navigate your way past the ruthless sentinels to gather the coveted solar cells and replenish the earth's energy.

Both are licensed from Bally Midway. CBS Software, 1 Fawcett Place, Greenwich, CT 06836.

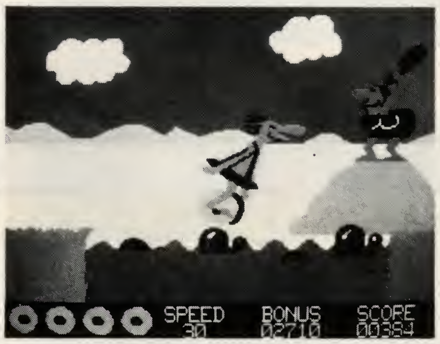
B.C. and the Wizard Of Id Come to Atari

Sierra On-line has brought several pre-historic characters into the 21st century.

Based on B.C. and the Wizard of ID comic strips, *Quest for Tires* stars Thor who zips through the world of "B.C." on his pre-historic unicycle. *Wiztype*, the first program in the new line of educational software is a typing tutorial. *Wizworld* challenges your knowledge of geography. *Wizlab* offers you a chance to become an amateur scientist, performing chemical experiments and observing the results. *Wizspell* measures your spelling ability as you twist your way through a maze.

Other entries are *Wizmath*, *Bung Juggler* and *Dot-To-Dot Zot*.

For further information contact Sierra On-Line, Inc., Sierra On-Line Building, Coarsegold, CA 93614.



Quest for Tires from Sierra On-Line.

Broderbund Rolls out Operation Whirlwind

War is hell, especially with your joystick as you struggle through the trenches of Broderbund's new World War II game.

Operation Whirlwind involves you in numerous skirmishes with the enemy testing your strategic ability. Suggested retail price is $39.95.

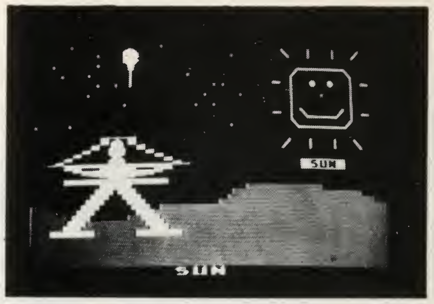
Broderbund Software, 1938 Fourth St., San Rafael, CA 94901.

Children's Stories from PDI

Teddy's Magic Balloon and *Robin's Halloween*, are two new interactive word skill games from PDI. They're directed at children five through eight and both combine a computer program with voice narration. The disk version of each requires a program recorder.

Picture Blocks, for children between the ages of four through ten, requires no reading skills and the program helps young children recognize shapes. It retails for $24.95.

PDI is located at 95 East Putnam Ave., Greenwich, CT 06830.



Teddy's Magic Balloon from PDI

Three VCS Games from Activision

Activision continues to crank out 2600 video games. *Decathlon* by David Crane opens with a torch bearing athlete trotting into a hushed stadium as the Olympic theme plays. Score 1,000 or more points on any event and you're rewarded with a trumpet fanfare.

Plaque Attack by Steve Cartwright is a self-defense course for the junk food junkie in the audience. Using the joystick to control a tube of toothpaste, you must squirt away at waves of junk food and between meal treats.

Robot Tank, designed by Al Miller, is a tactical battle against squadrons of cydernated attack tanks.

Contact Activision, Inc., 2350 Bayshore Frontage Rd., Mountain View, CA 94043.

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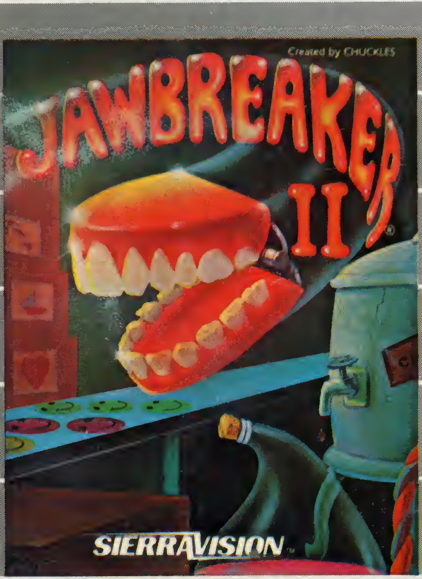
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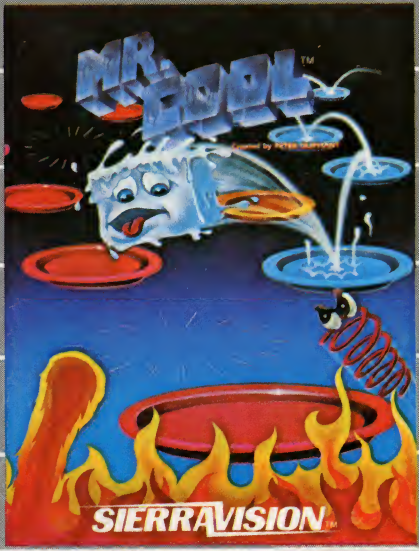
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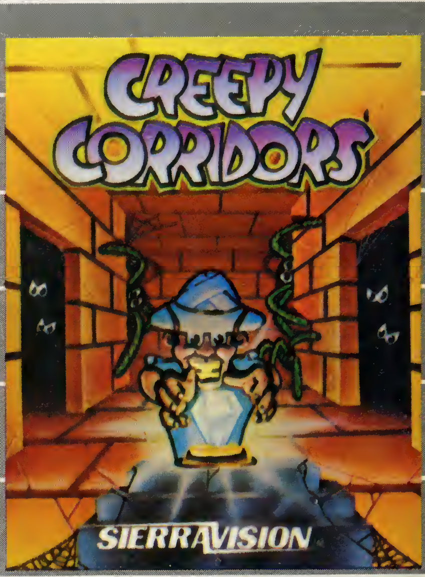
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